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The Significance of Knobbed Anal Keels in the Garter Snake, *Thamnophis sirtalis sirtalis* (Linnaeus)[1]

By Marjorie Brown Harrison

RECENTLY attention has been called by F. N. Blanchard[2] to certain peculiarities of the dorsal scales of the anal region in various species of snakes. These peculiarities are manifested as keel-like structures on smooth-scaled snakes, and as excrescences or knobs on the keels of keeled snakes. To determine the significance of these excrescences and their relation to sex and age in a species of garter snake, study was made at the suggestion of Dr. Blanchard of a series of 400 specimens of *Thamnophis sirtalis sirtalis*. All the specimens were loaned by the Museum of Zoology of the University of Michigan through the courtesy of Mrs. Helen T. Gaige, Curator of Amphibians.

In this species of garter snake, the well developed knobbed keels usually occur in the immediate vicinity of the anus, extending dorsally as high as the third or fourth row of scales. Keels with poorly developed excrescences may occur several millimeters farther anteriorly and posteriorly, and dorsally to the median line. Ordinarily, however, even poorly developed knobs do not appear higher up than the sixth or seventh dorsal scale rows.

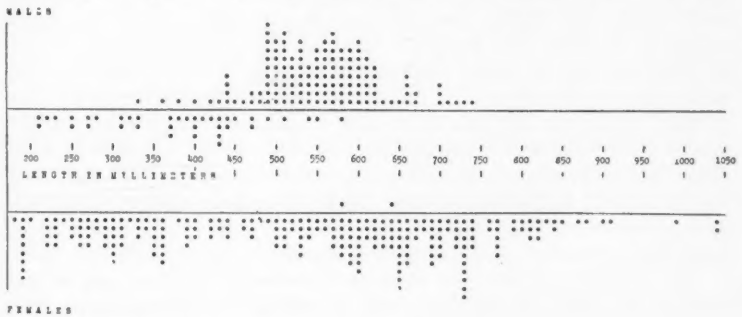

Fig. 1.—Graph showing distribution of knobbed anal keels in garter snakes. Upper figure, males; lower figure, females. Dots above the abscissa represent individuals possessing these knobs; those below represent individuals lacking them.

The number of scales bearing these knobs decreases with each ascending scale row until, on the sixth or seventh row, only two or three scales with knobs can be found. In the region of poorly developed knobs, there often occur two or three smaller knobs on a scale instead of a single larger one. A more exact description of the distribution of these knobs cannot be given because of the variability from one specimen to another and the progressive reduction anteriorly, posteriorly, and dorsally from the anus.

[1] Contribution from the Zoological Laboratory of the University of Michigan.
[2] Secondary Sex Characters of Certain Snakes. *Bull. Antiv. Inst.*, 4, 1931: 95-104.

To the unaided eye, the knobs on the dorsal scales of the anal region look like tiny pin-point projections in the middle of the keel. Their presence can be detected also by passing the fingers gently along the sides of the snake in this area. When magnified ten or more diameters, the knobs are easily visible. They appear as enlargements on each side of the normal keel, extending about one-fourth of the total length of the keel. In profile they show as little rounded elevations in the middle of the keel.

After examining all the specimens at hand (226 females and 174 males) under low magnification, it became apparent that these excrescences were characteristic of males, but only of the larger ones. A length of 475 mm. represented approximately the dividing length between individuals lacking these knobbed keels and those possessing them. The knobbed keels were present in 95 per cent of the males longer than 475 mm.; in only a very few of these individuals were the knobs not well developed. Of specimens less than 475 mm. in length, 29 per cent showed the knobs; in this group the character was usually weakly developed, i.e., the knobs were either few in number or of very small dimensions. Of the 226 females examined only two exhibited this character. One of these, 640 mm. long, showed the knobs as strongly developed as is typical for the male; in the other, 581 mm. in length (the tip of the tail was missing) they were only weakly developed. (See Fig. 1.)

It is difficult to determine exactly the relation of these knobbed anal keels to age in the garter snake since there appear to be no figures available for the minimum length of sexually mature males. It is apparent, however, that they appear when the snake has reached a certain size, which cannot in the nature of things be far from the minimum size at sexual maturity. It may be noted furthermore that the probable minimum size of sexually mature females of this species has been demonstrated by May D. Burt[3] to be about 550 mm. Since male snakes are often, if not generally, smaller than females, it is reasonable to assume that the length determined above for the first appearance of well-developed knobs, i.e. 475 mm., represents approximately the minimum length of sexually mature males. This leads to the assumption that the knobs on the anal keels of this garter snake are a secondary sex feature that appears at the reproductive age.

To determine whether this character is seasonal in appearance or permanent, the dates of collection (and presumably of preservation) were assembled for all specimens measured. With the exception of six specimens —four of which were taken in July, one in October, and one in the spring —all of the males above 475 mm. collected between the months of March and November showed these peculiar scales about the anus. No males of this size collected during the winter months were available for examination. From the data at hand, it would seem that once the feature is developed it persists throughout life, in contrast to the secondary sex characters of many species of fish, amphibians and birds.

Summary

1. The dorsal keels in the anal region of the garter snake *Thamnophis sirtalis sirtalis* are characteristically knobbed in males of a length greater

[3] COPEIA, 166: 1928, 8-12.

than 475 mm. In males under this length they are usually absent or very weakly developed. In females of all lengths they are generally absent.

2. The appearance of the knobs seems to depend on the attainment of sexual maturity, and once acquired the knobs seem to persist throughout life.

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Batrachia and Reptilia of Alachua County, Florida

By O. C. VAN HYNING

THE following list has been compiled from field notes and specimens positively identified; the majority of the specimens are in the collections of the Florida State Museum.

BATRACHIA

1. *Amphiuma means* Garden: Congo snake, ditch eel.—Moderately common; frequents swamps and ditches.

2. *Triturus viridescens dorsalis* (Harlan): newt.—Moderately common in ponds and ditches; land stage found under stones or boards near water.

3. *Ambystoma talpoideum* (Holbrook): ground puppy, mole salamander.—Larvae common in some ditches and ponds near Gainesville; adults not often seen, due to their burrowing habits.

4. *Ambystoma tigrinum* (Green): tiger salamander, ground puppy. —Rare; specimens from Archer, Newberry, and Worthington Springs.

5. *Plethodon glutinosus* (Green): slimy salamander, ground puppy. —Moderately common in and under rotten logs, in moist woods.

6. *Eurycea quadridigitatus quadridigitatus* (Holbrook): dwarf salamander.—Common in and under rotten logs and bark at edge of ponds and marshes; also among leaves in dried-up ponds in woods, and among roots of the water hyacinth (*Piaropus crassipes*). This very active salamander feeds well in captivity.

7. *Desmognathus fuscus auriculatus* (Holbrook): dusky salamander, spring lizard.—Common under stones, boards, and leaves, along streams and springs. Eggs found in numbers in September.

8. *Siren lacertina* Linnaeus: mud-eel, lampus eel.—Common in lakes and swamps. Young found in aquatic vegetation, in mud and shallow water.

9. *Pseudobranchus striatus* (Le Conte): striped eel.—Among roots of the water hyacinth and other aquatic vegetation. Not uncommon.

10. *Scaphiopus holbrookii holbrookii* (Harlan): spadefoot.—Very common at breeding time; seen on warm nights at the mouth of burrows, and hopping about in the woods.

11. *Bufo quercicus* Holbrook: oak toad, whistling toad.—Common, especially in the pine "flatwoods."

12. *Bufo terrestris* Bonnaterre: southern toad.—Very common everywhere.

13. *Acris gryllus* (Le Conte): cricket-frog.—Margins of lakes, ponds, streams and swamps; very common.

14. *Pseudacris nigrita* (Le Conte): black swamp frog.—Swamps and grassy ponds and ditches; moderately common.

15. *Pseudacris ocularis* (Holbrook): least swamp frog.—Wet grassy places, especially in the pine flatwoods; common.

16. *Pseudacris ornata* (Holbrook): ornate swamp frog.—Grassy ditches and ponds; moderately common.

17. *Hyla cinerea cinerea* (Schneider): green tree frog.—Common in weeds and bushes, especially near and over water. Occasional specimens resemble *H. c. evittata* in having the white lateral stripe nearly obsolete.

18. *Hyla crucifer* Wied: spring-peeper.—Ponds and ditches in and near woods; moderately common. Begins to call in December and January, on warm nights.

19. *Hyla gratiosa* Le Conte: Florida tree frog.—Common in ponds when breeding, but not often seen at other times.

20. *Hyla squirella* Latreille: squirrel tree frog.—Common when breeding; frequents gardens and is often seen in crannies about porches of houses.

21. *Hyla femoralis* Latreille: pine woods tree frog.—Moderately common; frequents the higher pine and oak woods.

22. *Hyla versicolor versicolor* (Le Conte): tree-toad.—Rare in the county; found breeding six miles northwest of Gainesville.

23. *Eleutherodactylus ricordii* (Duméril and Bibron): cricket-toad.—Moderately common in Gainesville and vicinity; found under debris. Their chirping notes are a common sound after dark and on cloudy days.

24. *Rana aesopus* (Cope): gopher-frog.—Moderately common on the oak ridges, remaining in or near the burrows of *Gopherus polyphemus* (Daudin), going to ponds only to breed.

25. *Rana catesbeiana* Shaw: bullfrog.—Moderately common; frequents margins of ponds, ditches and swamps.

26. *Rana clamitans* Latreille: spring-frog, bronze-frog.—Along small streams and springs, and in small pools in woods.

27. *Rana heckscheri* Wright: Wright's bullfrog.—Margins of cypress swamps and streams; not common. High Springs, Worthington Springs, Waldo, Gainesville.

28. *Rana grylio* Stejneger: green bullfrog, southern bullfrog.—Lakes and marshes; common. Our most aquatic frog.

29. *Rana sphenocephala* (Cope): southern leopard-frog, spring-frog.—Margins of streams and lakes, and marshy spots; common.

30. *Gastrophryne carolinensis* (Holbrook): narrow-mouthed toad.—Found under rocks, boards and debris; moderately common.

REPTILIA

31. *Alligator mississippiensis* (Daudin): alligator.—Moderately common in lakes and marshes, but much hunted.

32. *Anolis carolinensis* Voigt: chamaeleon.—Common on foliage of bushes and plants.

33. *Sceloporus undulatus undulatus* (Latreille): fence-lizard, alligator-lizard.—Moderately common.

34. *Ophisaurus ventralis* (Linnaeus): joint-snake, glass-snake.—Moderately common.

35. *Cnemidophorus sexlineatus sexlineatus* (Linnaeus): six-lined lizard, race-horse.—Common in dry sandy locations; very swift.

36. *Leiolopisma laterale* (Say): ground-lizard.—Common on the ground, among dead leaves.

37. *Eumeces egregrius* (Baird): red-tailed skink.—Three miles west of Gainesville, Florida, January 7, 1932. Two adult specimens collected by Mr. A. F. Carr.

38. *Eumeces fasciatus* (Linnaeus): scorpion lizard, red-headed lizard.—Found in wooded sections; moderately common.

39. *Rhineura floridana* (Baird): worm-lizard.—Moderately common, but seldom seen except when plowed up, or after a heavy rain; burrows in the ground.

40. *Abastor erythrogrammus* (Daudin): rainbow-snake.—Frequents spring-fed rivers; rare. Santa Fe River at High Springs.

41. *Farancia abacura* (Holbrook): horn-snake, red-bellied snake.—Swamps and marshes, burrowing in the mud; moderately common.

42. *Diadophis punctatus punctatus* (Linnaeus): ring-neck snake.—Under bark and debris; not common.

43. *Heterodon contortrix* (Linnaeus): spreading adder, hog-nosed snake.—Fields and margins of woods; moderately common. The black phase is occasionally found in the county.

44. *Heterodon simus* (Linnaeus): southern hog-nosed snake.—Habits similar to those of the preceding species; moderately common.

45. *Opheodrys aestivus* (Linnaeus): green grass-snake, magnolia snake.—Arboreal; not uncommon.

46. *Coluber constrictor constrictor* (Linnaeus): black-snake.—Common.

47. *Masticophis flagellum flagellum* (Shaw): coach-whip, whip-snake.—Frequents the sandy oak ridges; not common.

48. *Elaphe guttata* (Linnaeus): rat-snake, corn-snake.—Frequents fields and out-buildings; moderately common.

49. *Elaphe obsoleta confinus* (Baird and Girard): gray chicken-snake, rat-snake.—Wooded areas; rare in the county. Gainesville.

50. *Elaphe quadrivittata* (Holbrook): white-oak runner, yellow chicken-snake.—Woods and out-buildings; common.

51. *Drymarchon corias couperi* (Holbrook): gopher-snake, indigo-snake.—Sandy oak ridges; not common.

52. *Pituophis melanoleucus mugitus* (Barbour): pine-snake.—Flatwoods and oak ridges; uncommon. Specimens approach *P. m. melanoleucus* in color pattern.

53. *Leimadophis flavilatus* (Cope): yellow-lipped snake.—Under bark or logs; rare. Gainesville.

54. *Lampropeltis elapsoides elapsoides* (Holbrook): scarlet king-snake.—Wooded sections; not common.

55. *Lampropeltis getulus getulus* (Linnaeus): king-snake.—Moderately common; prefers damp woods, and vicinity of swamps.

56. *Lampropeltis getulus floridana* Blanchard: Florida king-snake.—Rare in the county; seems to be the northern limit of its range.

57. *Stylophis extenuatus* (Brown): short-tailed snake.—Rare. Gainesville.

58. *Cemophora coccinea* (Blumenbach): scarlet snake.—Wooded areas; not common.

59. *Natrix cyclopion* (Duméril and Bibron): green water-snake, moccasin.—Streams, ponds, lakes and marshes; common.

60. *Natrix rigida* (Say): striped water-snake.—Rare. Gainesville, Micanopy.

61. *Natrix fasciata fasciata* (Linnaeus): water-snake, moccasin.—Very common in and near water.

62. *Natrix taxispilota* (Holbrook): water rattle, brown water-snake, moccasin.—Shores of lakes and streams; common.

63. *Seminatrix pygaea* (Cope): mud-snake, red-bellied snake.—Among roots of aquatic vegetation, and under logs or boards at the water's edge; moderately common.

64. *Storeria occipito-maculata* (Storer): red-bellied snake.—Under bark of dead logs; rare.

65. *Storeria victa* Hay: brown snake.—Near marshes and wet grassy prairies; not common.

66. *Liodytes alleni* (Garman): Allen's mud-snake.—In aquatic vegetation and burrowing in muck; locally common.

67. *Thamnophis sauritus sackenii* (Kennicott): southern ribbon-snake.—Moderately common; semi-aquatic.

68. *Thamnophis sirtalis sirtalis* (Linnaeus): grass-snake, garter-snake.—Common throughout the county.

69. *Tantilla coronata* Baird and Girard: crowned snake.—Under debris; secretive and rare.

70. *Micrurus fulvius fulvius* (Linnaeus): coral-snake, bead-snake, garter-snake.—Under rocks, logs and debris; not common.

71. *Agkistrodon piscivorus* (Lacépède): water-moccasin, cotton-mouth.—Moderately common about marshes and lakes.

72. *Sistrurus miliarius* (Linnaeus): ground rattler.—In moist or rocky situations; not common.

73. *Crotalus adamanteus* Beauvois: diamond-back rattlesnake.—Pine flatwoods and oak ridges; moderately common.

74. *Crotalus horridus* Linnaeus: swamp rattler, banded rattlesnake.—Rare in the county; one specimen from Worthington Springs.

75. *Sternotherus minor* (Agassiz): southern musk-turtle.—Santa Fe River; moderately common.

76. *Sternotherus odoratus* (Latreille): musk-turtle, stink-pot.—Streams, ponds and ditches; moderately common.

77. *Kinosternon bauri* Garman: striped mud-turtle.—Common in both large and small bodies of water.

78. *Kinosternon steindachneri* Siebenrock: Steindachner's mud-turtle.—Rivers and springs; moderately common.

79. *Macrochelys temminckii* (Holbrook): alligator-snapper.—Santa Fe River; rare. High Springs.

80. *Chelydra osceola* Stejneger: Florida snapper.—Moderately common.

81. *Chelydra serpentina* (Linnaeus): snapping turtle.—Less common than the preceding species.

82. *Terrapene carolina triunguis* (Agassiz): box-turtle.—Moderately common; frequents the pine flatwoods.

83. *Pseudemys floridana* (Le Conte): Florida cooter, striped-neck cooter.—Lakes, ponds and streams; common.

84. *Pseudemys rubriventris* (Le Conte): red-bellied cooter.—Similar to the above in habitat and numbers.

85. *Pseudemys scripta* (Schoepff): yellow-bellied cooter.—Lakes, ponds and strcams, moderately common.

86. *Deirochelys reticularia* (Latreille): chicken-turtle.—Ponds and ditches; moderately common.

87. *Gopherus polyphemus* (Daudin): gopher-tortoise.—Excavates and inhabits burrows on the oak ridges; common.

88. *Amyda ferox* (Schneider): soft-shelled turtle.—Lakes and streams; moderately common.

FLORIDA STATE MUSEUM, GAINESVILLE, FLORIDA.

On Three Races of *Bufo typhonius*

By BENJAMIN B. LEAVITT

BUFO typhonius is a species of toad inhabiting a wide range in Central and South America. Those familiar with this species have for a long time recognized a variation among specimens from widely separated localities but have not correlated these differences to form races. It has been my privilege to examine a series of one hundred and ninety specimens from a number of localities in many parts of this range. The specimens include

those in the Museum of Comparative Zoology collection and some kindly loaned from the Museum of Zoology, University of Michigan, by Mrs. Helen Gaige. Careful examination of the material at hand reveals that this species may be divided into three races, for each of which names are already available.

Bufo typhonius typhonius (Linnaeus)

This subspecies extends from Venezuela south and east through the Guianas and well south through Brazil. The most distinguishing feature of this group is a prominent knob at the posterior angle of the upper jaw. This character, mentioned in descriptions of the species, is absent from the members of the other two races. Other distinguishing characters of this race are larger size, more dumpy appearance, the tarso-metatarsal articulation when extended reaching to the eye but never beyond the front of the eye, and the lateral ridge of tubercles extending forward traversing the length of the parotoid gland.

Bufo typhonius alatus Thominot

Bufo alatus, described by M. A. Thominot (Bull. Soc. Philom., ser. 7, 8, 1884: 151), has long been relegated to synonymy but may now be recognized as a valid race. The type locality was Obispo, Isthmus of Panama. The range of this subspecies includes as much of Central America as it inhabits and extends south and east into Venezuela and south and west into Colombia. The toads of this area lack the pronounced knob at the angle of the jaw, they are smaller than those of the Guianas and Brazil, the tarso-metatarsal articulation reaches to the front of the eye or beyond, the parotoid is not usually traversed by a row of tubercles but is thin, elongate and tapers to a point posteriorly, and the general habit of the toads is more slender.

Bufo typhonius chanchanensis Fowler

Bufo chanchanensis has also been long relegated to syonymy, but may now be recognized as a valid race. This species was described by H. W. Fowler (Proc. Acad. Nat. Sci. Phila., 65, 1913: 155–156). The type locality was Camp Chiguancay in the Chanchan River Valley, western Ecuador. The members of this race also lack the pronounced knob at the angle of the jaw, the width of the head between the posterior end of the cephalic crests is equal to or greater than twice the height of the head from the angle of the jaw to that point, and the parotoid is less narrow and more globular than that of the more northerly race.

It should be added that these characters are not applicable to the young individuals of this species. Of 190 specimens examined 44 were too small to show racial characters, 47 are *Bufo typhonius typhonius,* 66 are *Bufo typhonius chanchanensis,* and 33 are *Bufo typhonius alatus.*

KEY

1. Head with pronounced knob at angle of jaw .....*B. typhonius typhonius*
   Head without such a knob .....2.
2. Width of head between the posterior end of the cephalic ridges is equal to or greater than its height from angle of jaw to that point .....*B. typhonius chanchanensis*
   Width of head less than twice its height .....*B. typhonius alatus*

MUSEUM OF COMPARATIVE ZOOLOGY, CAMBRIDGE, MASSACHUSETTS.

Studies on Neotropical Colubrinae

III. The Taxonomic Status of Certain Neotropical Racers

By L. C. Stuart

In the course of completing a taxonomic revision of certain neotropical genera allied to *Drymobius* I have found it necessary to synonymize certain forms of doubtful validity and, conversely, to recognize as valid other species which had been relegated to synonymy. The following embodies my conclusions with respect to these forms.

Drymobius rubriceps Amaral.—Although the type of this species has not been available, Amaral's description (1) is so complete that nothing is left to the imagination. Whereas Amaral (2) suggests that this form may be synonymous with *Eudryas b. boddaertii* (Sentzen), I believe that it represents a slightly aberrant specimen of *Drymoluber brazili* (Gomez). This conclusion is based on the following facts.

1.—The type locality, Pennapolis, Brazil, is located well beyond the southern-most record of *E. b. boddaertii,* but lies within the known range of *D. brazili.*

2.—The type has 117 pairs of subcaudals. This is far too many for *E. b. boddaertii* in Brazil but within the subcaudal range of *D. brazili.*

3.—The anal plate of the type is single, an almost constant condition in *D. brazili* but only occasionally found in *E. b. boddaertii.*

4.—The supralabials in the type are 7 in number. This is a likely condition in *D. brazili* which normally has 8, but less so in *E. b. boddaertii* which normally has 9.

Dendrophidion paucicarinatus (Cope).—This species, originally described from La Candelaria, Costa Rica, by Cope (3), has apparently been forgotten since its description. Three specimens in the Museum of Zoology, University of Michigan, have been compared with the type, American Museum of Natural History, No. 17269, and have been found to coincide in all particulars. I have also seen a specimen in the Museum of Comparative Zoology, Harvard University. This species is readily distinguishable from *D. dendrophis* (Schlegel) both by its coloration and greater number of ventral scutes, which are less than 175 in *D. dendrophis* and more than 180 in *D. paucicarinatus.* All specimens which I have examined are from Chiriqui Province, Panama, at elevations over 4,000 feet. Material from lower elevations proves to be *D. dendrophis.* This rare species appears to be confined to the high mountains of western Panama and southern Costa Rica.

Leptodrymus pulcherrimus (Cope).—Dunn (4) has shown that *Leptodrymus clarki* (Amaral) is synonymous with *Masticophis pulcherrimus* Cope and has recognized *Leptodrymus* as a valid genus. Since then I have studied briefly the genus *Salvadora* and have been tempted to place *S. mexicana* in the genus *Leptodrymus.* Dr. Dunn, however, has clarified the situation; I quote from a recent letter received from him:

"If other characters bear out an arrangement *pulcherrimus-mexicana-bairdi,* I personally would not let the rostral modification stand in my way,

since *mexicana* has the rostral less modified than *bairdi,* and *pulcherrimus* has it normal."

Inasmuch as hemipenial characters, scutellation, and pattern are more or less constant throughout the group, *Leptodrymus clarki* should be relegated to the synonymy of *Salvadora pulcherrimus* (Cope).

Dendrophidium melanotropis Cope and *D. chloroticum* Cope.—Amaral (5) has recently published a note on these two species which has left matters in a regrettable tangle. In his opinion the two species are conspecific and represent synonyms of *D. dendrophis* (Schlegel). Dr. Dunn, however, has recently sent me a very good description of the types, which are deposited in the United States National Museum, and I have examined specimens of *chloroticum* preserved in the collections of the Museum of Comparative Zoology, Harvard University. Furthermore, excellent descriptions of both *chloroticum* and *melanotropis* in the British Museum (Natural History) have been available. From this material it is evident that the two species are quite distinct and are in no way related to *D. dendrophis.* Both forms belong to the genus *Drymobius* as it has been recently redefined (6) and are directly related to *D. rhombifer* (Günther). The latter species ranges from South America northward to Costa Rica. In Costa Rica and Nicaragua it is replaced by *D. melanotropis,* which in turn gives way to *D. chloroticus* in Honduras, Guatemala, and Mexico. The following table shows the ventral scutellation and readily separates *melanotropis* from *chloroticus* (means in parentheses):

	Ventrals	Subcaudals	Total Abdominals
D. rhombifer	149–169 (157)	84–103 (95)	239–267 (252)
D. melanotropis	152–163 (156)	93– 96 (94)	245–256 (250)
D. chloroticus	152–170 (164)	112–122 (118)	266–290 (277)

It is quite probable that *melanotropis* and *chloroticus* intergrade in southern Honduras and northern Nicaragua, but material at hand shows no evidence of this condition.

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Testudinata from South-eastern Georgia, Including the Okefinokee Swamp

By C. Ralph De Sola and Fredrica Abrams

THE following list extends the known geographical range of those species marked with an asterisk (*) as compared to locality data published by Ditmars, Boulenger (G. A. and E. G.), Siebenrock, and Stejneger and Barbour, brings new material to the fore, and helps fill the gap

that exists to such a marked degree in the faunistic literature of Georgia and its great swamp, the Okefinokee.

*1. *Sternotherus carinatus* (Gray), musk terrapin.—Found in eastern portion of Okefinokee and locally known as "Stinkin Jenny."

2. *Kinosternon subrubrum subrubrum* (Lacépède), mud box terrapin. —Common on the hundred foot sandy ridge surrounding the Swamp and called "Highland Stinker."

3. *Macrochelys temminckii* (Holbrook), alligator snapping terrapin. —Locally known by that name, as superstition has it that this terrapin is the offspring of an alligator and a snapping terrapin. Specimens are frequently hooked in the old drainage canal (St. Mary—Suwanee Canal) near Camp Cornelia in the Okefinokee.

*4. *Chelydra osceola* Stejneger, southern snapping terrapin.—Found in Swamp and in streams forming the Satilla and Altamaha rivers.

*5. *Terrapene carolina triunguis* (Agassiz), three-toed box terrapin.— Common along the ridge of the Okefinokee and in forest lands near Folkston. One specimen was taken on the Savannah-Jacksonville highway near White Oak.

6. *Terrapene major* (Agassiz), striped box terrapin. — Common from Savannah to St. Mary's and inland on the high river ridges.

*7. *Malaclemys centrata centrata* (Latreille), *M. centrata concentrica* (Shaw), *M. pileata pileata* (Wied), *M. pileata littoralis* (W. P. Hay), *M. pileata macrospilota* (W. P. Hay), diamond-back terrapin.—Found in the coastal marshes from Isle of Hope, Savannah to Blythe Island, Brunswick. This remarkable and complete representation of the genus is due to the fact that every year imported specimens escape from commercial crawls and seek refuge in the surrounding salt marshes where they thrive, multiply, and are often recaptured. Considerable variation exists in the separate races and it is probable that interbreeding has occurred. Mr. Leon E. Robarts of Brunswick was of considerable help in supplying specimen material for the New York Aquarium.

8. *Chrysemys picta picta* (Schneider), eastern painted terrapin.—The species most commonly observed in fresh-water ponds back of the coastal marsh.

9. *Pseudemys floridana* (Le Conte), Florida terrapin.—Very common in the Swamp where the local people refer to it as "cooter" in imitation of the original African name for a fresh-water terrapin—"kouta."

10. *Deirochelys reticularia* (Latreille), chicken terrapin.—Found in river drainages and in the Okefinokee where it is esteemed for its flesh.

11. *Gopherus polyphemus* (Daudin), gopher tortoise.—Still found within the original type locality, "Savannah and Altamaha Rivers, Georgia." The eggs are laid in mid-July, four to a clutch, and buried at the sandy entrance to their burrows. John Foster Godley of White Oak was responsible for a collection of six adult specimens now being exhibited in the New York Aquarium. Considerable dimorphism of an anatomical nature exists between the sexes and this will be dealt with in a paper now in preparation. These tortoises were formerly so common that the natives

used them in trade and barter in place of money much in the manner that Indians used wampum.

12. *Amyda ferox* (Schneider), soft shell terrapin.—Common in all rivers and in the old canal of the Okefinokee. Specimens in the Okefinokee attain a length of two feet.

13. *Chelonia mydas* (Linné), Atlantic green turtle.—Occasionally taken in shrimp trawls off the Sea Islands (Sapelo, St. Simon's, Jekyl and Cumberland) and within St. Simon's Sound.

14. *Eretmochelys imbricata* (Linné), Atlantic hawk's-bill turtle.—Rarely seen on Georgia coast although one specimen was taken in a pound net off Savannah late in July, 1931.

15. *Caretta caretta* (Linné), Atlantic loggerhead turtle.—Common off the Sea Islands where it breeds during June and July and into early August, having mated in April and May, while hatching takes place in November and December of the same year.

16. *Caretta kempii* (Garman), Kemp's bastard-turtle.—Is often confused with the preceding species and it has been erroneously thought to be the hybrid offspring of the hawk's-bill and the loggerhead although records prove the species to be common. As regards size, which is usually overstated owing to the confusion of the species with a much larger one, the loggerhead, it is well to cite records made by C. M. Breder, Jr., of the New York Aquarium and those made by us in Brunswick, proving the turtle to be a small species with adults rarely over two feet in length. Dissection of two foot specimens revealed well developed eggs and the fact that although the intestinal tract measures seven times the body length and would appear to be fitted for vegetable diet, stomach contents show the spotted lady crab, *Platyonichus ocellatus,* to be the mainstay of the animals regimé. Turtles of this size weigh about eight pounds and have the same habits and places of breeding as those given above for the loggerhead.

The following key should prove serviceable to naturalists in differentiating between confusing species that heretofore have been separated on skull characters, not to be determined in specimens either alive or intact.

A—Limbs in form of flippers; five costal plates on each side.

B1—Body golden brown above, immaculate yellow beneath; fore flippers with two claws each—Loggerhead turtle, *Caretta caretta*

B2—Body uniform dusky grey above, pale white beneath; fore flippers with three claws each—Kemp's bastard turtle, *Caretta kempii*

17. *Dermochelys coriacea* (Linné), trunk-back turtle.—Seldom recorded from this coast although we saw one good sized specimen off Cape Romain, South Carolina on August 5, aboard the S. S. *City of Savannah.*

The work accomplished was largely aided and made possible by the kind interest and sustained efforts of Mr. Victor R. Abrams and Mrs. J. B. Abrams of Brunswick, Mr. Clyde Brown of that city, Mr. M. V. Haas of Savannah and Mr. John M. Hopkins of Darien, who made work in the Okefinokee a pleasure as well as a success.

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Hibernation of the Box Turtle[1]

By Alvin R. Cahn

THE early issues of Copeia contain a number of notes on the habits of box turtles in relation to hibernation and aestivation. Thus Nichols (3, 1914) remarks about a box turtle active in December in New Jersey; Culver (22, 1915) discusses one swimming a creek; Overton (26, 1916) calls attention to the fact that *T. c. carolina* takes to water in hot weather; Engelhardt (31, 1916) reports aestivation in a burrow of mud near water; Babcock (49, 1917)shows that young box turtles take to water in captivity; and Wetmore (77, 1920) describes the hibernation in dirt. Some recent observations by the writer may be of interest in regard to the hibernation of *Terrapene carolina carolina.*

When I left Urbana, Illinois, in June, 1931, I turned 17 specimens of *Terrapene ornata* and 24 specimens of *T. carolina carolina,* all native Illinois specimens, loose in an outdoor pen. This pen has a natural dirt surface, with numerous shrubs, herbs and grasses growing in it. At one end a water pipe runs a constant stream to form a little puddle about a yard square and some 6 inches deep. The females were with eggs, as dissection of some specimens of both species showed, and it was hoped that they would eventually present me with young turtles for study. A count of noses on my return in September showed all turtles present and accounted for, but there were no young. However, on October 2, I suddenly found 5 young of *T. carolina carolina* crawling about and headed for the pond at the opposite end of the pen; one was already in the water. All 6 babies eventually congregated in the water, where I collected them. This brood of 6 accounts for the activities of one adult female, and that is all the young I have found. Incidentally it may be noted that this aquatic tendency of young box turtles may well explain why small specimens of the species are so seldom found in the field; half buried in the muck and leaves at the bottom of a pond they are very hard to locate.

With the approach of cooler weather in late October, every specimen of *T. ornata* dug in and disappeared while all of the *T. carolina carolina* remained out and active. On November 2 these began to dig in, and 7 of 24 went into hibernation. A week later 5 more began to dig in, but these, as well as the preceding 7, came out again during the day, repeating the performance of digging in in the late afternoon and coming out again in the morning, for five days and nights. Then for three more days 7 other specimens joined in the temporary nocturnal hibernation. At the end of this time all 19 went in for good. While this large group was deciding whether or not to hibernate, it was noted that the remaining 5 turtles had entered the pond and were lying entirely quiescent in the water, head and legs drawn in. They were in such a position in relation to the bank that they could get their nostrils out of water without moving the body. And there they remained all winter, moving hardly at all during the period from December to March, with few exceptions. On January 28 one was out on the shore, but it returned to the water early in the afternoon and did not

[1] Contribution from the Zoological Laboratory of the University of Illinois, No. 422.

come out again. The air temperature at this time was 11° C. That same noon another specimen made the mistake of leaving the pond and wandering 10 yards away; two days later it was found frozen to death. On January 30, the air was 3° C, the water 10° C. On this day two were completely submerged and two had their heads out of water. These latter specimens had rested their heads on a mass of brush and the spray from the running water had frozen their snouts fast to the vegetation. They were cut out and responded sluggishly to touch, but were uninjured. On February 1, I took a series of temperature readings: air 5.5° C; water 10° C; body temperature of submerged turtles (rectal) 9.5° C. Subsequent readings showed the body temperature to remain about 1° below that of the surrounding water. All four turtles that remained in the water during the winter survived, and left the pond April 4 for the more serious business of life.

From all of which we must conclude that water plays a considerably larger part in the life of the common box turtle, *Terrapene carolina carolina*, than has been generally suspected.

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Locomotion and Diurnal Range of *Sonora occipitalis*, *Crotalus cerastes*, and *Crotalus atrox* as Seen from their Tracks

By Walter Mosauer

WHEN studying reptiles in the Sahara in 1928 the writer realized that the tracks left in the fine sand are not only an indispensable aid in collecting but can also furnish information on various questions concerning the life history of the animals. The tracks are a graphic record of the animals' activities that supplement the scarce opportunities of actual observation. It is obvious that the special features of every kind of track are indicative of the type of locomotion applied. This may be shown here on the example of snake tracks.

In the course of a previous research the writer was able to distinguish three main types of ophidian locomotion. The first of these, applied by all colubrid snakes and many others, is the typical serpentine movement, that I have termed horizontal undulatory movement. The second type is the sidewinding or rolling movement which was analyzed as the sidewise rolling of a screw or helix. The third type is the "caterpillar movement" in which the snake propels itself by reciprocal movements of its integument and its body within the tube of skin. Furthermore, snakes can move by simply bending and straightening parts of their bodies.

The writer is at present carrying on ecological research on the reptiles of a sand dune belt of the Colorado desert. Here the types of locomotion mentioned above are beautifully illustrated by three snakes, *Sonora, Crotalus cerastes*, and *Crotalus atrox*. The horizontal undulatory movement is

represented by the progression on the surface of the small burrowing snake, *Sonora occipitalis*. The track of this snake, seen very commonly everywhere on the sand, has the shape of a regular sinuous curve. Small sand piles, heaped up behind the oblique sections connecting the vertices of the curve, demonstrate the forces applied to the substratum in this horizontal undulatory movement. This is used exclusively and with amazing regularity, as seen from the uniformity of the track. It is very efficient since both the tracks and the actual observation of the snake show that there is hardly any slippage of the pressing sections, which would result in a loss of energy. Such slippage, causing futile wriggling and waste of effort, is demonstrated by a snake trying in vain to progress on glass or on a very smooth floor. It does not, however, occur under natural conditions, not even on loose sand, as proved by *Sonora*.

The typical tracks of sidewinding snakes as described by the writer, are produced in the Colorado desert by *Crotalus cerastes*. Many specimens were collected by following their tracks. To the beginner in this method it seems difficult to discern the direction of the course. Indeed, it can be recognized only from two details. There is a little hook at one end of each ribbon, made by the neck, and a slightly curved cross bar at the other end, due to the dragging of the tail. It may seem strange that the end having the tail mark points in the direction of the course, but an understanding of the formation of the track explains this apparent paradox. A study of the tracks left by the nocturnal ramblings of the sidewinder reveals the fact that it progresses by its typical looping for most of the distance covered, but that it also moves by alternately bending and straightening, leaving irregular marks in the sand. Sluggish snakes that have just started on their trip and are not as yet warmed up, use it more often than is characteristic of the species. This could be seen from a case in which, one evening, a track was found emerging from a kangaroo rat hole and the snake was discovered not far from it, still cold and indifferent. The sidewinder rarely uses the "caterpillar movement."

The latter is applied extensively by the big *Crotalus atrox*. The track is a wide band with longitudinal stripes, looking as if something had been dragged over the sand. No marks of the ventral scutes are visible. Where the snake has been travelling downhill or on the level, the track may be fairly straight, indicating that the rattler has slowly crept along like a gigantic caterpillar. On ascending inclines some undulatory movement, or more frequently, bending and straightening, aid the caterpillar movement. Such points in the track make it possible to recognize which way the snake has gone; from a track of pure caterpillar movement this cannot be seen.

If one knows what tracks are formed by the different types of locomotion and the preference for each of the latter by the different species of snakes, it is, of course, possible to recognize a track as that of a certain species. By following it, however, one can gain more information. So it could be seen that *Sonora occipitalis* does not travel far on the surface. It emerges at night from one of the little hills of firm soil and travels to another hill nearby, traversing the intervening stretch of fine sand. Sometimes it travels as far as the distance between two or three hills, always

passing over those on its way, as its usual habitat is to be considered the soil between the roots of shrubs which grow on the hills. The distance covered in one night hardly exceeds 100 feet.

The process of emerging from one hill, going to another, and leaving the surface again, may be repeated at intervals during one night, as could also be seen from the tracks.

Quite different is the behavior of the sidewinder. This snake seems to travel extensively. Tracks could be followed over more than a thousand feet, and this would scarcely represent the whole distance actually covered, since the tracks were usually lost on firmer ground and could not be traced to the end. A small specimen, hardly exceeding 10 inches in length, had travelled approximately 1000 feet. The course is quite erratic, changing direction very frequently. Yet most of these tracks that were followed for a considerable distance, retained a direction roughly uniform throughout the course. Frequently the snake was found at the end of the track, coiled spirally in the sand at the base of a plant. Apparently the sidewinder does not inhabit a certain permanent refuge, but rambles at night over the desert and settles down for rest at any convenient place, spending each day at a different point, chosen at random. It may be, however, that the individual returns during the following night or nights to the point from which it started, thus maintaining a territory covered in several nights, but this does not seem very likely. On its way over the desert the sidewinder does not usually pass through shrubs and over hills, but seems more inclined to go around their base. This may be due to its type of locomotion, which is not very practicable within the closely set stems of the shrubs.

In this respect the diamondback (*Crotalus a. atrox*) differs very decidedly from the sidewinder. A track of a large specimen was followed for a considerable distance. The snake had kept an approximately straight course east-west, visiting every shrub and overgrown hill on its way. Through 34 such points it had gone, probably in the search of food. It was found in a deserted rodent burrow, where the track ended. The snake had proceeded most of the way by caterpillar movement aided in some places by short undulations.

The foregoing account intends to show that "tracking" is not only an efficient means of collecting sand inhabiting reptiles, but can also furnish information concerning their habits that can hardly otherwise be obtained.

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Twelve New Philippine Fishes

By Albert W. Herre

1.—*Solenostomus* ***phantasticus,*** new species

Dorsal V—17; anal 18; pectoral 24; ventral 7.

The depth is 6, the head a little more than 2, the snout 3, the caudal 3.6, the first dorsal height 3.77, the ventral 4 times in the length; the eye is 7.7, the pectoral 10, the longest second dorsal and anal rays 11.66 times in the head. The depth at the middle of the snout is 7.5 times in the snout length; the least depth of the caudal peduncle is 2.29 times in its own length.

The first dorsal, unlike that of other known species, rises from an elevated base; including this, the depth is 4.6 times in the length; the length of the first dorsal base is 4 mm., that of the second dorsal 6.7 mm., and of the anal 6 mm.; the distance from the second dorsal base to the origin of the caudal membrane is 7 mm. The depressed first dorsal reaches the middle of the second dorsal; the ventrals extend beyond the middle of the anal; their posterior margin is convex.

The head (but not the snout) and trunk have many stout short blunt spines on the anterior half; behind the first dorsal and ventral origins they are sparse but are sharper and curve backward; tubular filaments, scattered over the whole body, become abundant and more elongate on the dorsal and ventral profiles back to and including the anterior margin of the first dorsal.

When first taken from the water the color was light red with many short stripes and cabalistic markings of deep maroon.

In alcohol the ground color is pinkish, the markings of reddish brown, the dermal tubules black; the first dorsal has two greatly elongated black spots between the first and third spines; the rest of the fin, the ventrals and caudal are marked like the body.

Here described from the type and only specimen, a female 72 mm. long, obtained with other small fishes from eel grass at Dumaguete, Oriental Negros, Philippine Islands.

2.—*Dampieria* ***atrofasciatus,*** new species

Dorsal II—25; anal III—14; the upper section of the lateral line has 51, the lower 21 tubulated scales plus 2 more on the caudal base; there are about 60 scales from the opercular angle to the caudal base, and 26 predorsal scales which extend forward to above the middle of the eye; 5 scales above the origin of the lateral line, 3 scales above the lateral line at the middle of the dorsal; 9 transverse, 11 vertical rows of scales on the preopercle.

The depth is 2.7, the head 3.18, the rounded caudal 3.6, the pectoral 4, the ventral 4.2 times in the length; the eye is 4⅛, the snout 3.3, the least depth of the caudal peduncle 2, the interorbital very slightly more than 5 times in the head; the 12th anal ray equals the 23rd dorsal ray, 4.2 times in the length or 1.3 times in the head.

The body is strongly compressed, with boldly convex dorsal profile;

the maxillary extends to a vertical a trifle in advance of the pupil, its length 2.35 times in the head; there is a pair of very small canines at the tip of the upper jaw, with a pair of large canines some distance behind; 4 rows of fine teeth at the front of the upper jaw and a single row of enlarged teeth laterally; the lower jaw has a pair of large canines anteriorly and 2 pairs of canines laterally; behind the anterior canines are 3 or 4 rows of blunt teeth and a few stout teeth in a single row posteriorly; there are 2 rows of fine teeth on the vomer; gill rakers (including rudiments) 6+12.

The color in alcohol is dark brown, with the caudal and all behind a line connecting the 23rd dorsal and 12th anal rays pale yellowish; on the side a series of 14 blackish brown lines inclined slightly backward extend from the dorsal base below the pectoral or to the anal base, the first one from the base of the 4th dorsal ray, the last one opposite the 25th ray; the first 8 lines are in pairs, the next 4 are broad, the last 2 thin; each scale on the body in advance of the first vertical line has a blackish brown spot, these spots forming conspicuous rows; the dorsal is a dusky brown with a black ocellus on the base of the 22nd to 24th rays, a black spot on the base of each ray, and the lower half of the fin with vertical or diagonal black bands; the upper part of the anterior portion of the dorsal is marked by circular black spots on the membrane, over which are small white spots; the posterior half is marked by longitudinal black lines above; the anal is uniformly blackish brown, the ventrals smoky brown, the pectoral clear, with a blackish brown spot at the upper angle of its base.

Here described from the type and only specimen, 105 mm. long, obtained by me at Culion, Philippine Islands.

3—*Pseudochromis* ***colei,*** new species

Dorsal III—23; anal III—14; the upper part of the lateral line has 28 tubulated scales, the lower 9, plus 1 on the caudal base; 32 scales in a median longitudinal series, plus 6 on the caudal base; there are 14 predorsal scales, 2 above and 10 below the lateral line; the upper margin of the opercle has 4 very small teeth.

The depth is 3.47, the head 3.18, the caudal 3.57, the pectoral 4.9, the pointed ventral 4.37 times in the length; the snout is 3.62, the eye 3.85, the maxillary 2.4, the interorbital 6.16, the third dorsal spine 2.57, the third anal spine 3.6 times, the least depth of the caudal peduncle 1.875 times in the head; the 11th anal ray equals the 16th dorsal ray, approximately 6 times in the length.

The preopercle has 5 rows of scales; there are 4 anterior canines in the upper jaw and 2 much larger ones in the mandible, with bands of fine teeth in both jaws anteriorly and a single row posteriorly; the vomer has 2 central teeth and a pair of teeth posteriorly on each side; the palatines have a row of fine teeth; the trifurcate caudal has filamentous prolongations in both the upper and lower half; gill rakers 5+10, plus 2 rudiments; branchiostegals 6.

The color in alcohol is tan with a dark brown longitudinal stripe from the upper lip through the eye and along the upper part of the body to the upper part of the caudal, its middle portion twice as wide as either the

anterior or posterior part; above this longitudinal band the color is light brown; the dorsal and anal are pale, each with a brown marginal line; the other fins are pale and unmarked.

Here described from the type and only specimen, 59 mm. long, collected by me at Culion, Philippine Islands.

Named in honor of Dr. Howard I. Cole, chemist of the leper colony at Culion, whose enthusiastic cooperation and generous aid alone made possible my large and interesting collection from Culion.

4.—*Pseudochromis* **similimus,** new species

Dorsal III—23; anal III—12; there are 32 tubulated scales in the upper, 9 in the lower part of the lateral line, plus 1 on the caudal base, and 38 scales in a longitudinal series to the caudal base with 2 more on the latter; 20 predorsal scales, 3½ scales above and 15 below the lateral line; the upper margin of the opercle has 3 teeth.

The depth equals the head and is contained 3.14 times, the caudal 3.66, the ventral a little more than 5 times in the length; the snout equals the eye and is contained 4 times, the interorbital 4.66, the least depth of the caudal peduncle 1.91, the third dorsal and anal spines each 2.8 times in the head. The maxillary extends beneath the anterior margin of the eye, its length 2.8 times in the head; the dorsal and anal are highest posteriorly, the third ray from the end apparently longest, about 5.5 times in the length or 1.75 times in the head; there are 3 transverse rows of scales on the preopercle; the caudal is broken but apparently had a filamentous prolongation near its upper and lower margins; the vomer and palatines have numerous fine teeth; the slender gill rakers are 5+10; branchiostegals 5 (?).

The color in alcohol is very pale yellowish, with a black stripe from the upper lip to the eye and from the eye upward and backward to the dorsal where it fuses with a black band extending over the basal half of the dorsal back to the 20th ray; 2 or 3 rows of scales below the anterior half of the lateral line have a blackish dot on each scale; the predorsal region is more or less dusky, the top of the snout dark drab. The fins, except for the dorsal band mentioned, are all like the body.

Here described from the type and only specimen, 44 mm. long, obtained by me at Culion, Philippine Islands.

5.—*Holacanthus* **chapmani,** new species

Dorsal XV—15 or 16; anal III—16 or 17; there are 43 to 46 tubulated scales in the lateral line, 6 or 7 above and 21 to 23 below it, and 46 to 49 scales in a longitudinal series from the angle of the opercle to the caudal base.

The oblong-ovate body is much compressed, thickest anteriorly, the anterior dorsal and ventral profiles strongly and evenly convex but the dorsal profile steeper, the ventral more rounded; the depth is 1.83 to 2, the head 3.45 to 4, the caudal 1.45 to 1.8, the pectoral 4 to 4.66, the ventral 3.25 to 3.5, the longest dorsal and anal rays 4.5 to 5 times in the length; the snout is 2.75 to 3, the eye 3.5 to 4, the interorbital 3 to 3.15, the preopercular spine 2.5 to 3.3, the least depth of the caudal peduncle 1.85 to 2 times in the head.

The upper and lower lobes of the lunate caudal are excessively elongated and filamentous, twice to nearly 3 times as long as the head; the middle rays of the dorsal and anal are longer than the spines, the fins angulate; the ventrals have filamentous tips.

The color in alcohol is lavender brown to very pale brown dorsally, whitish tan or very pale yellowish below the level of the eye; a black interocular stripe across the snout is continued behind the eye and just below the lateral line as a black or blackish longitudinal band as wide as the eye for part of its length, descends diagonally across the caudal peduncle and extends out on the lower lobe of the caudal to its filamentous tip; below this band are 3 black parallel longitudinal stripes starting at the hind and lower margins of the eye, the two lower ones crossing the preopercle and opercle, or the lower one may begin at the pectoral axil; these stripes are cut off by the upper band as it crosses the caudal peduncle but may continue beyond it as lines of dashes and dots; the largest specimen has a faint brownish bar beginning below the pectoral base and running to the lower side of the caudal peduncle; a broad black or blackish brown band covers the spinous dorsal and upper half of the soft dorsal; the rest of the soft dorsal, the anal and the central part of the caudal are pale reddish to whitish, thickly sprinkled with small dark reddish brown circular spots and dots; a submarginal black band extends along the upper caudal lobe, both lobes of the caudal with a marginal white line; the pectorals and ventrals are colorless.

Here described from the type and paratype, 115 and 95 mm. in length respectively, from Dumaguete, Oriental Negros, 3 paratypes 96 to 126 mm. in length from a reef between Burias and Ticao Islands, and a paratype 101 mm. long from Jolo, Philippine Islands. The paratype from Dumaguete is in the zoological museum of the University of Michigan.

This handsome angel fish is separated from *Holacanthus lamarcki,* with which it has been confused, by its distinctive arrangement of lateral stripes, the absence of a predorsal patch of yellow, pale ventrals instead of black, its shorter head, small preopercular spine, etc. A comparison of this species with my colored plate of *H. lamarcki* (*Phil. Journ. Sci.,* 34, 1927: 183, pl. 16) will show the differences at a glance.

I take pleasure in naming this species in honor of Dr. James W. Chapman, of Silliman Institute, Dumaguete, Oriental Negros, to whose generosity and enthusiastic assistance I am indebted for many rare and little known fishes.

6.—*Hemipteronotus* **nigromaculatus,** new species

Dorsal II—VII—12; anal III—12; there are 20 or 21 tubulated scales in the upper part, 4 or 5 in the lower section of the lateral line and 1 more on the caudal base, 5 above and 10 below the line; there are 7 vertical and 8 transverse rows of scales on the cheek, the lowermost behind the angle of the mouth.

The body is greatly compressed; the dorsal profile of the head very boldly convex, the anterior profile very sharply keeled and nearly vertical, the head a little deeper than long; the depth is 2.7, the head 3.1, the caudal

and pectoral each 5.16, the ventral 7.17 times in the length; the small eye equals the interorbital, 6 times in the head; the snout is 1.75, the maxillary 3.33, the least depth of the caudal peduncle 2.4 times in the head.

The second dorsal spine equals the eleventh dorsal and anal rays, 3.33 times, the last dorsal spine and first ray each 4.55 times in the head; the third anal spine is 6.25, the first anal ray 5 times in the head; the first 8 dorsal rays seem to be undivided.

The color in alcohol is very pale yellowish, with a large, nearly rectangular whitish blotch on the side, partially covered by the pectoral. The fins are concolorous, the dorsal with a large black circular spot on the upper part of the two last rays; the caudal shows traces of at least 4 wavy cross bars and the lower part of its tip is dusky gray. In life the dorsal was evidently bright yellow.

Here described from the type and only specimen, 155 mm. long, collected at Jolo, Sulu Archipelago, Philippine Islands. This species is near *H. melanopus* and *H. twistii,* but is sufficiently unlike both.

7.—*Scarus* **ophthalmistius,** new species

Dorsal IX—10; anal III—9; 17 scales in the upper, 6 in the lower section of the lateral line, plus 1 or 2 on the caudal base with tubules, 1 scale above and 6 below the lateral line, and 6 predorsal scales; there are 3 rows of scales on the cheek, none on the preopercular flange.

The depth equals the head and is contained 2.85 times in the length; the snout is 2.33, the eye 5 to 5.4, the interorbital 3.5, the least depth of the caudal peduncle 2.2 to 2.3 times in the head.

The body is much compressed laterally, the dorsal profile sloping gently in a straight line to above the eyes, then more steeply descending to the tip of the elongate snout. The dorsal is highest anteriorly, the third spine 2.45 to 2.66, the ninth spine 2.9, the first ray 2.8 to 2.85, the eighth ray 2.35 to 2.5 times in the head; the third anal spine is 4 to 5 times, the first anal ray 3, the eighth anal ray 2.7 to 3 times in the head. The lips cover the basal half of the white teeth; there are no canines; gill rakers flexible, short, 10 on the lower limb.

The color in alcohol is warm reddish brown, each scale below the lateral line with a black vertical basal bar; there is a broad black band over the nape and down the posterior margin of the opercle to the level of the pectoral base; a black interocular stripe continues below the eye diagonally forward and downward behind the mouth and across the throat, uniting with its fellow from the other side; the dorsal is dusky gray with a large black ocellus extending from the third to the sixth spines; on one specimen there is a black line below the ocellus and a black marginal line above; the caudal is dusky basally, its posterior half orange red; the other fins are all very pale reddish.

Here described from the type, 143 mm. long, and paratype 114 mm. long, both collected by me at Jolo, Sulu Archipelago, Philippine Islands. This species is unique among scaroids in its coloration.

Ophthalmistius, sail-eye, in allusion to the dorsal ocellus.

8.—*Scarus* ***visayanus,*** new species

Dorsal IX—10, anal III—9; the tubulated scales of the lateral line are 19 or 20 on the upper, 5 on the lower section, plus 2 on the caudal base; 22 scales in a median longitudinal series with 2 more on the caudal; 1 or 1½ scales above and 6 below the lateral line; 6 predorsal scales; 2 rows of scales on the cheek with a third row of 2 to 4 scales on the preopercular flange; the lower teeth are fully exposed, the upper about half covered, or in one specimen fully exposed; no canines except in one paratype which has a small upper posterior canine on each side.

The depth equals the head, about 3 in the length, but in one specimen (a female just through spawning?) the depth is 2.66; the pectoral equals the caudal, 4.65 to 4.85 times, the ventral 5.5 to 6 times in the length; the dorsal profile is low and very gently sloping, the ventral profile much more convex, the elongate snout is 2.45 to 2.6 times, the interorbital 3 to 3.3, the least depth of the caudal peduncle 2 to 2.5 times in the head; the eye is distinctly smaller in the largest specimen than in the others, 5.85 to 6.66 times in the snout, or 2.3 to 2.5 times in the snout.

In the type specimen the dorsal is of uniform height for most of its length, the ninth spine and the first and ninth dorsal rays of equal height, 2.9 times in the head; the third anal spine is 3.9 times, the first to eighth anal rays 3.33 times in the head; the caudal is truncate when fully expanded, or the tips of its upper and lower margins may be slightly elongated and the fin then a little concave.

The dorsal fin, head, and almost the whole of the trunk are very deep violaceous brown, becoming a little paler or shading to grayish brown on the belly and above the anal, or the belly and region above the anal may be yellowish; the caudal and anal are clear yellow, or the anal and tip of the caudal may each have a dark brown marginal line; the pectoral base and the pectoral above a diagonal from the lower end of the base to the tip of the fin are dark brown like the body, the rest of the fin clear; the ventral is largely dark brown, its inner membranes clear.

Here described from the type, 208 mm. long, and paratype 185 mm. long, from Taytay, Palawan, a paratype 208 mm. long from Linapacan Island, Palawan Province and another paratype 222 mm. long from a reef between Burias and Ticao Islands, Philippine Islands.

9.—*Mars* ***caeruleo-maculatus,*** new species

Dorsal VI—I—10; anal—9; there are 60 scales in a longitudinal series.

The type is a male 33 mm long; its slender body is laterally compressed, its depth 5, head 3.47, the rounded caudal 3.66 times in the length; the eye equals the snout, 4.1 times, the least depth of the caudal peduncle 2.7 times in the head, which is broad with bulging cheeks, its width equal to the body depth; the upper jaw has a short outer row of caniniform teeth behind which is a band of 3 or 4 rows of very small teeth; there is a similar band in the lower jaw and a pair of small canines at the outer angle of the mandible; the vomer has two large wide teeth; I could detect none on the palatines; the body is covered with ctenoid scales, smallest anteriorly and ceasing above the pectoral base, the head and nape being

naked back to the dorsal origin; the snout, top and sides of the head are criss-crossed by rows of sensory papillae; the fourth spine of the first dorsal is highest, 1.35 times in the head; the second dorsal and anal rays are of nearly uniform height, the sixth ray in each fin 1.6 times in the head; the large ventral extends nearly to the anal, 1.2 times in the head; the ventral frenum is very thin, fragile and inconspicuous.

A female paratype 31 mm. long was nearly ready to spawn and has a much more robust body, its depth 3.875, its head 3.33 times in the length.

The color in alcohol is olive brown all over, with 7 darker transverse bands across the back and down the sides, where they seem to form a longitudinal series of spots; small pearl blue spots are scattered over the body, most evident on the posterior half; the head is dappled with paler and darker brown mottlings; the first dorsal may have a blackish stripe on its upper half before the second and succeeding spines, or the spines may be marked by several rows of blackish spots; the soft dorsal has 3 rows of large oval dusky spots on its membrane; the anal and ventrals are blackish, the other fins pale.

Four additional paratypes, 23 to 37 mm. in length, offer no differences except that they are sprinkled with blackish spots instead of pearly blue. The six specimens were collected on the tide flats at Jolo, Sulu Province.

The genus *Mars* has hitherto been known from but a single specimen, collected by David Starr Jordan at Samoa. From *Mars strigillifer* Jordan and Seale, to which the Philippine species is closely related, my specimens differ in the squamation, shorter head, different first dorsal, and entirely different color pattern.

Gladiogobius, new genus

This remarkable goby is set apart from the rest of the family by the possession of a large spine, shaped like a rooster's spur, at the posterior angle of the preopercle; the head and nape are naked, with no scales before the dorsal; there are no silk-like filamentous pectoral rays; the teeth are in a narrow band above and in two rows below, well separated, the inner of depressible teeth; the tip of the tongue is rounded; the ventrals are close together and united basally by a very thin and readily destroyed membrane, but are free from each other for most of their length, as in eleotrids; however this fish is a true goby; the breast and pectoral base are scaled.

Dorsals VI—I—9 or 10; anal I—8 or 9; scales ctenoid, 24 to 30 longitudinally.

10.—*Gladiogobius* ***ensifer,*** *new species*

Dorsal VI—I—9 or 10; anal I—8 or 9; there are 24 to 26 scales in longitudinal, 11 in transverse series.

The depth is 4, the head 3.65, the caudal 3, the pectoral 3.4, the ventral 3.77 times in the length; the snout is 4.65, the eye 4, the least depth of the caudal peduncle 2.15 times in the head. The spur-like spine at the lower posterior angle of the preopercle extends to the hind margin of the opercle. The tips of the dorsal spines are elongated and thread-like, the third or fourth excessively so, and then 2.85 to 3 times in the length;

the rays of the second dorsal and anal increase in height posteriorly, the eighth dorsal ray sometimes elongated, and then 3 times in the length; the last anal ray a little shorter, 1.1 to 1.3 times in the head.

The color in alcohol is brownish white with 5 dark brown blotches along the middle of each side, the last at the caudal base, and with several dark brown saddle bands and blotches along the back; the nape and sides are mottled with small dark brown spots which form longitudinal rows posteriorly; the sides of the head and pectoral base are covered with ocellated pearly white spots; there is a large blue-black spot above the upper angle of the opercle, one at the lower end of the pectoral base, and a pair on the breast just behind the head; the fins may be almost colorless, or vary to brown or dusky, with rows of pale spots; the dark gray ventrals have a dark brown spot at the inner basal angle and a dark brown spot under the base of each fin.

The type, 33 mm. long, and paratype, 31.5 mm. long, were obtained by me near the entrance to Majalibit Inlet, Waigiu; the type is in the Field Museum of Natural History.

Two more specimens, from which this description is drawn, were obtained at Culion, Philippine Islands, their lengths 34 and 28 mm.

This goby is entirely unlike any seen among the many thousands of gobies I have examined, and there is nothing like it in any available literature. The finding of this strange little fish in these two widely separated localities is one more link in the chain of evidence which links into a biologic unit the fishes of that part of the Pacific surrounded by the Caroline and Pelew Islands, New Guinea and other large islands to Celebes and Borneo, and the Philippines.

11.—*Callionymus* **zaspilus**, new species

Dorsal IV—8; anal I—7; pectoral 24; caudal 10.

The depth of the short, thick-set body is 3.66, the head a trifle more than 3, the caudal 2.95, the ventral 3.44, the least depth of the caudal peduncle 5.5 times in the length. The breadth of the head is eight-ninths of its own length. The eye is 2.6, the small pointed snout 3, the interorbital space 3.75, the preopercular spine 2.77, the least depth of the caudal peduncle 1.8, the pectoral 1.5 times in the head.

The first dorsal is low, the first spine 2.25 times in the head; the second dorsal is of nearly uniform height, the sixth ray 1.8 times, the pectoral 1.5 times in the head; the eighth anal ray equals the ventral and is eight-ninths of the length of the head.

The preoperular spine has two small, slightly curved spines on its upper margin and ends in a slender, slightly curved point; the ventrals are longer than the pectorals but do not reach the anal.

This dumpy little fish is decorated like a circus clown. The ground color of body and fins is gray; the dorsals, anal, pectorals, and ventrals, their bases and the adjacent parts of the body are marked by large conspicuous circular blue spots or bands formed by the fusion of such spots, each spot or band margined by a heavy white line, outside which is a broad indigo blue stripe, then another white stripe and lastly a thin blackish line;

there is a similar large circular spot on the belly and several small spots of the same kind on the head, each with four borders also; the basal portion of the caudal has a broad blue transverse band, likewise margined on both sides by four stripes; the iris has a silvery-golden lustre, and from it radiate 6 or 7 black margined green stripes over the outer part of the eye, like spokes of a wheel; two are extended and cross the interorbital space, uniting with their fellows from the other eye; two others descend to the throat, but do not meet the others.

In life the gray ground color was light blue, the spots indigo blue.

Here described from the type and only specimen, 28 mm. long, collected by me at Sitankai, Sibutu Islands, Sulu Archipelago. A much smaller specimen was also obtained on the Sitankai reef, on another occasion, and notes taken of it, but thus far it has not been located.

This species is near *Callionymus splendidus* Herre, from Bungau, Tawi Tawi, Sulu Archipelago, but is quite distinct.

12.—*Opisthognathus* **suluensis,** new species

Dorsal 24 or 25; anal 16; there are 130 to 140 rows of scales from the opercular angle to the caudal base, and about 90 tubules in the lateral line, which ends a little beyond the middle of the trunk.

The depth is 5, the head about 3.15, the maxillary 3.1 to 3.25 times in the length; the eye is 4.6 to 4.85, the interorbital 7.2 to 7.3, the snout 5.0 to 5.5, the broad pectoral 2.4 to 2.6, the caudal 2.2 to 2.3, the pointed ventral about 2.2 times in the head.

The body is slender, elongate, laterally compressed, the large head with a strongly convex dorsal profile; the small scales are widely spaced, becoming reduced to dots anteriorly; the maxillary extends to the pectoral base; the vomer is toothless.

The head and upper half of the body are violet brown in alcohol, with two parallel irregularly blotched lateral stripes, one from the upper end of the gill opening to the caudal, the other from the pectoral axil to the caudal; on the head are two broad darker brown transverse bands running diagonally backward and downward toward the gill opening; the under side is whitish; the lower half of the dorsal is clear, with 9 large dark brown rounded spots which lie half on the fin and half on the back; the upper half of the dorsal is dark brown with a whitish spot behind each spine and ray and with a white marginal line; the anal is violet brown; the caudal shows traces of dark irregular cross bands; on the inner surface of the elongate maxillary are two concentrically arranged violet brown stripes.

Here described from type, 160 mm. long, and paratype 140 mm. in length, obtained by me at Sitankai, Sibutu Islands, Sulu Archipelago.

The type specimens of all the species described above are deposited in the Zoological Museum of Leland Stanford Junior University.

Zoological Museum, Stanford University, California.

A Probably Undescribed Codfish from Arctic America

By J. T. Nichols and Amos Maxwell

TWO small codfish obtained in Lincoln Bay, Arctic America (Greenland sector), by Peary in 1906, have been overlooked in the collections of the American Museum of Natural History until recently.

They are not *Boreogadus saida* (Lepechin) as at first supposed, and with which they have been compared. Their dentition is similar, but they have a larger eye, more developed barbel, lunate versus forked caudal, longer paired fins, and different fin formula.

They seem more closely related to *Boreogadus esmarkii* (Nilsson), suggesting the figure of that fish in Jenkins' *Fishes of British Isles* (1925: pl. 56), but have fewer fin rays, vent more posterior in relation to the first dorsal interspace, than such, as described by Günther (*Catalogue of the Fishes in the British Museum*, 4, 1862: 337-338), etc.

Recent authors refer Richardson's *Gadus ogac* (1836), we may assume correctly, to a northern representative of the cod, *Gadus morrhua* Linnaeus. Nevertheless it is notable that we find nothing in his imperfect type description thereof to exclude our Lincoln Bay fish, which is not closely related to *G. morrhua*. Furthermore the measurements of *G. ogac* given by Dresel (*Proc. U. S. Nat. Mus.*, 7, 1884 (1885): 247) show a fair degree of agreement with comparable measurements thereof, and the fin formula is not far different. The eye is notably larger and fins longer in our specimens, which might be correlated with smaller size. Of the included lower jaw and other characters of true *Gadus* he says nothing, except by inference of close relationship to *G. morrhua*.

It seems best to describe the larger specimen (which may stand as the type) of our Lincoln Bay fish as provisionally new. It is No. 9699, American Museum of Natural History.

Boreogadus **pearyi**, new species

Length to base of caudal, 224 mm. Depth in this length, 7; head, 3.6. Eye in head, 3.2; interorbital, 4.2; snout, 3.2; maxillary, 2.5; barbel, 6.5; length of peduncle, 2.5; longest ray of first dorsal, 1.6; of first anal, 2; caudal lobe, 2.5; pectoral, 1.3; ventral, 1.1. Barbel in eye, 2; depth of peduncle, 2.3.

Dorsal rays, 12-20-21; anal, 23-22. Scales, about 155. Teeth pointed, slightly curved, moderately spaced, in about 2 series in upper and front of lower jaw. A row of well spaced unequal teeth on the vomer and on the palatines (as in *Arctogadus* Drjagin, 1932).

Vent under first ray of second dorsal. Lower jaw appreciably projecting; maxillary extending to below front of pupil; pectoral base behind ventral base a distance about equal to half the diameter of eye; both paired fins long, reaching about to vent. The tips of the ventrals filamentous; caudal lunate.

Color faded, fins somewhat darker than body.

American Museum of Natural History, New York City.

A Catalog of the Fishes of Central Minnesota

By George W. Friedrich

FISHES have been studied and recorded in certain sections of Minnesota, as by Evermann and Latimer in the Lake of the Woods district and by Surber in various parts of the state, especially in the southeast. Little attempt has been made in the past to determine what fishes inhabit the waters of central Minnesota.

This district has been quite thoroughly investigated during the past two years and all species obtained are listed below together with their locations. Specimens of each species are preserved and cataloged in the Museum of the State Teachers College. Specimens of doubtful species were sent to Hubbs and Greeley of the Museum of Zoology of the University of Michigan for verification of the identification.

1. *Lepisosteus platostomus* (Rafinesque). Short-nosed gar.—In Lock Lake, 15 miles from St. Cloud. Taken while lake was seined for rough and destructive fishes. Among the first of these fishes to be found in the lakes of central Minnesota, and hence the farthest north.

2. *Amia calva* Linnaeus. Bowfin.—Occasionally found in the Mississippi River near the St. Cloud Power House and Little Rock Lake, 10 miles north of St. Cloud.

3. *Leucichthys artedi* (Le Sueur). Lake herring.—Found in Mille Lacs Lake. Seeks shallower water in the fall. Keys out as *L. artedi hankinsoni* Koelz, the Oneida Lake tullibee, but does not look much like it when compared with specimens. The subspecies is being investigated by Hubbs.

4. *Coregonus clupeaformis neo-hantoniensis* (Prescott). Inland lake whitefish.—Two adults speared in Whitefish Lake, about 30 miles north of Brainerd. They seem to represent an extreme form of the type called *neo-hantoniensis* by Koelz. The pectoral fins are nearly black, and very large (1.1 in interval between pectoral and pelvic fins).

5. *Salmo trutta* Linnaeus. Brown trout.—In Cold Spring Creek, 15 miles from St. Cloud. Planted.

6. *Salvelinus fontinalis* (Mitchill). Brook trout.—In Cold Spring Creek. Planted.

7. *Megastomatobus cyprinella* (Cuvier and Valenciennes). Red-mouthed buffalo.—Briggs Lake, 13 miles from St. Cloud. Taken while lake was being seined for rough and destructive fishes. No specimen was preserved. The most common of the buffalo fishes in Minnesota according to a report of the State Game and Fish Commission.

8. *Catostomus commersonnii* (Lacépède). Common sucker.—Common in many of the lakes and streams of the vicinity.

9. *Hypentelium nigricans* (Le Sueur). Hog Sucker.—Snake River near Mora.

10. *Moxostoma aureolum* (Le Sueur). Northern red horse.—Found in the Mississippi River and other streams and lakes.

11. *Semotilus atromaculatus atromaculatus* (Mitchill). Creek chub.—Found in the Mississippi River and tributaries.

12. *Margariscus margarita nachtriebi* (Cox).—Inlet to Little Rock Lake, about 15 miles north of St. Cloud.

13. *Rhinichthys atronasus meleagris* Agassiz. Northern black-nosed dace.—Very plentiful in the Mississippi River near the college.

14. *Nocomis biguttatus* (Kirtland). River chub.—In the Mississippi River, Sauk River, and other neighboring streams.

15. *Notropis deliciosus stramineus* (Cope). Straw-colored minnow.—Specimens taken from the Mississippi River at St. Cloud.

16. *Notropis dorsalis dorsalis* (Agassiz). Back-striped shiner.—Quite common in the Mississippi River and its tributaries, some of which have sand bottoms. This appears to be a new state record.

17. *Notropis hudsonius selene* (Jordan). Northern spot-tail.—This species was found in large numbers in Clearwater Lake, about 22 miles south of St. Cloud.

18. *Notropis whipplii spilopterus* (Cope). Satinfin.—Found in fair numbers in the Mississippi River. Dr. Hubbs informs me that his Minnesota record for *N. lutrensis* (in Hubbs and White, 1923) was based on this form.

19. *Notropis cornutus frontalis* (Agassiz). Northern common shiner.—Common in streams of the vicinity.

20. *Hyborhynchus notatus* (Rafinesque). Blunt-nosed minnow.—Common in the Mississippi River and its tributaries.

21. *Notemigonus crysoleucas crysoleucas* (Mitchill). Golden shiner.—Recently taken in the inlet creek of Little Rock Lake, 15 miles north of St. Cloud.

22. *Pimephales promelas promelas* Rafinesque. Fathead minnow.—Common in the Mississippi River and its tributaries and lakes of the vicinity.

23. *Cyprinus carpio* Linnaeus. German carp.—Now quite common in the lakes south of St. Cloud. Specimens were taken from Briggs Lake. They are also found in the Mississippi River. Up to 1920 they had not appeared above St. Anthony's falls, Minneapolis.

24. *Ameiurus melas melas* (Rafinesque). Black bullhead.—In the Sauk and Mississippi rivers.

25. *Ameiurus natalis* (Le Sueur). Yellow cat.—In the Mississippi River.

26. *Ameiurus nebulosus nebulosus* (Le Sueur). Common bullhead.—In the Mississippi and Sauk rivers.

27. *Schilbeodes gyrinus* (Mitchill). Tadpole cat.—In the Sauk River near St. Cloud.

28. *Umbra limi* (Kirtland). Mud minnow.—Found in large numbers in the Lily Pond at the edge of St. Cloud near the Mississippi River, and in the Sauk River near Rockville.

29. *Esox lucius* Linnaeus. Great northern pike.—Common in lakes and large streams.

30. *Esox masquinongy immaculatus* (Garrard). Tiger muskallunge. —Mississippi River at St. Cloud.

31. *Fundulus diaphanus menona* Jordan and Copeland. Menona killifish.—Found in the Sauk River at Rockville and Mille Lacs Lake.

32. *Percopsis omiscomaycus* (Walbaum). Trout-perch. — Several specimens were taken from the Mississippi River.

33. *Eucalia inconstans* (Kirtland). Brook stickleback.—Found in the Lily Pond, Cold Spring Creek, and west branch of the Snake River.

34. *Lota maculosa* Le Sueur. Burbot.—In the Mississippi River near the St. Cloud Power House and Mille Lacs Lake.

35. *Labidesthes sicculus sicculus* Cope. Brook silverside.—Little Rock Lake, Mississippi River and Clearwater Lake.

36. *Aplites salmoides* (Lacépède). Large-mouthed black bass.—Quite common in the Mississippi River, Pleasant Lake, and other lakes. Young specimens are still alive in the college aquaria after five months of confinement.

34. *Micropterus dolomieu* Lacépède. Small-mouthed black bass.—In the Mississippi River and Snake River near Mora. Less common than the large-mouthed black bass.

35. *Apomotis cyanellus* (Rafinesque). Green sunfish.—Found associated with the pumpkinseed, bluegill and yellow perch near the shore of Pleasant Lake.

36. *Helioperca incisor* (Cuvier and Valenciennes). Bluegill.—One of the more common fishes of Pleasant Lake and other lakes of the vicinity and the Mississippi River.

37. *Eupomotis gibbosus* (Linnaeus). Pumpkinseed.—With the bluegill it is the most common sunfish of Pleasant Lake and lakes of the vicinity and of the Mississippi River.

38. *Ambloplites rupestris* (Rafinesque). Rock bass.—Specimens were taken from the Mississippi and Sauk rivers. They are common in the lakes and streams of this vicinity.

39. *Pomoxis sparoides* (Lacépède). Calico bass.—Found in Pleasant Lake and similar lakes of the vicinity and Knife and Ann rivers near Mora.

40. *Boleosoma nigrum nigrum* (Rafinesque). Johnny darter.—Fairly common in the Mississippi and Sauk rivers.

41. *Percina caprodes semifasciata* (De Kay). Northern log perch.—Quite commonly found in the Mississippi and Platte rvers.

42. *Poecilichthys exilis* (Girard). Iowa darter.—One specimen was taken from the Mississippi River; common in the shallow water of Mille Lacs Lake, also found in Pleasant Lake.

43. *Perca flavescens* (Mitchill). Yellow Perch.—Specimens were taken from the Mississippi River and Pleasant Lake. Common in the waters of this vicinity.

44. *Stizostedion vitreum* (Mitchill). Wall-eye.—Specimens were taken from the Mississippi River. They are common in the lakes and larger streams of this vicinity. The smaller individuals are commonly confused with the sand pike or sauger, specimens of which have not to date been identified in this vicinity.

45. *Cottus cognatus* Richardson. Eastern miller's-thumb.—Specimens taken from the Skunk River near Pierz and the St. Croix River.

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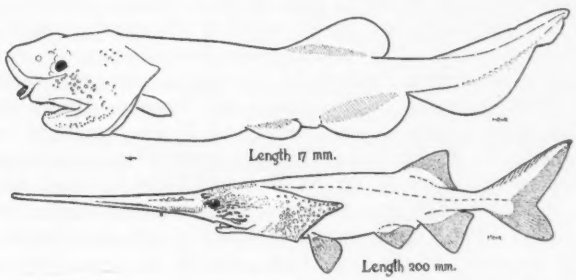
The Finding of Very Young *Polyodon*

By David H. Thompson

On the morning of May 14, 1932, seven small ganoid fishes ranging in size from 17 to 20 millimeters were collected from the Mississippi River near Grand Towers, Illinois. These have been identified as young of *Polyodon spathula.*

These postlarvae of *Polyodon* were taken by Mr. Charles N. Planthaber, Mr. Carl O. Mohr, and myself in the course of about a dozen hauls with a 20-foot one-sixth inch mesh minnow seine at the head of a large island in the Mississippi River two miles below the town of Grand Tower. At that time a channel about 50 yards wide ran between the head of this large island and an extensive sand bar to the right of it. This channel was about four feet deep in the center with a current estimated at one or two miles per hour. The bottom was of hard packed sand with a few bits of water-logged wood and rubbish. The water temperature was about 55° F. and the turbidity quite high. These young spoonbill were taken along with numbers of the big river shrimp, *Palaemon ohionis*, and



Postlarva and young of *Polyodon spathula*

a few small minnows, sunfishes, and dragonfly nymphs. Had it not been for the general scantiness of life in the Mississippi these postlarvae would most likely have gone unnoticed. They were pale and translucent and so small that most of them fell through the meshes of the seine and into the sand as it was hauled from the water. There they lay motionless until placed in water where they made a few feeble swimming movements. Four of them were preserved on the spot in 80 per cent alcohol and three carried back to the laboratory boat, "Anax," where they were preserved in formalin, although they had already died. Drawings of the smallest of the latter, and of a 200 mm. specimen made by Mr. Mohr are reproduced in the accompanying figure in order to show the striking change in external appearance of this fish. It was supposed at the time that these were young sturgeon, *Scaphirhynchus platorhynchus,* which is common in the Mississippi at this point, and little attention was paid to them beyond labeling the vials and putting them away.

While I was a student under the late Professor John Sterling Kingsley, he challenged those of us with pretentions as field naturalists to go out and get the developmental stages of the spoonbill. He pointed out that the spoonbill exhibits characteristics intermediate between those of the existent shark-like fishes and ganoid fishes, and that it evidently belongs to a very ancient group, since, of the two living species, one inhabits waters flowing into the Gulf of Mexico while the other lives in waters flowing into the Yellow Sea. Walbaum[1] in 1792 described *Polyodon* as a species of shark; and Rafinesque,[2] who described it under at least three different names, once made an elaborate description of it under the name *Proceros* "a singular new genus of sharks."

The reader may wonder why it has taken a century to secure a dozen small specimens of this conspicuous and common fish of the Mississippi valley. This scanty yield seems to me to be associated with the fact that spawning takes place, and the young grow up, in the swift and turbid portions of the main channel of the Mississippi, where biological phenomena of all sorts are largely "sights unseen." The evidence indicates that the spoonbill migrates extensively through a wide variety of large river and bottomland lake habitats, all of which are more or less inaccessible to tackle used for collecting such material. It also seems likely that the most desirable stages are passed within a few days' or weeks' time. The smallest specimens of *Polyodon,* known heretofore, are those of the Museum of Comparative Zoology of Harvard University, which came from the private collection of Professor Louis Agassiz. Doctor Barbour[3] reports that these include a poorly preserved 35 mm. specimen collected in Arkansas by Mr. G. Stolley and brought to the Museum prior to 1860. Well preserved specimens 37, 65, 80, 85, and 93 mm. in length were collected in September 1854, near St. Louis, Missouri, by a Doctor Eastman. Dr. William F. Allen,[4] in the course of a year's systematic search in the vicinity of the mouth of the Ohio, took some 25 specimens 4 to 6 inches in length on July 1, 1904, and a great many specimens from 6 to 12 inches in length late in August or early in September. In 1911 Doctor Danforth[5] described a 74 mm. specimen collected on July 12, 1910, from the Mississippi River near St. Louis, as well as a number of other small specimens including examples 89, 91, 104, and 107 mm. long. During February and March, 1930, Mr. Francis D. Hunt and I collected about 50 specimens from the Mississippi River at Chester, Illinois, ranging in length from 200 mm. to 500 mm. with still larger numbers ranging up to almost one meter in length, but none larger.

One of the best accounts of the spawning of *Polyodon* which has come to my attention was given Mr. Hunt by Mr. Charles Rudolph, a commercial fisherman of Havana, Illinois. On an evening, a number of years ago, when he was fishing near Grafton, Illinois, he heard a loud splashing and commotion near the island which lies at the confluence of the Illinois and

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[1] Walbaum. 1792. Artedi Pisc.: 522.
[2] Rafinesque. 1820. Ichth. Ohiensis: 86–87.
[3] Barbour, T. 1911. Biol. Bull., 21: 207-208.
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the Mississippi. Upon rowing across, he found that it was made by large spoonbill evidently in the act of spawning. One individual, supposedly the female, lay more or less quiet, while others, presumably males, continually leapt about, lacing her body on all sides. In the failing light and commotion of the water it was impossible for him to observe more accurately what was taking place.

In summarizing this information, one notices that all the more direct evidence concerning the spawning of *Polyodon* is limited to the Mississippi River from the mouth of the Illinois to the mouth of the Ohio, a distance of about 200 miles. This stretch of river is swifter and more turbid than the upper Mississippi, the Illinois, or the Ohio, where the adult spoonbill are most often taken. Commercial fishermen report the almost complete disappearance of the spoonbill from the upper Mississippi following the construction of the Keokuk dam. A great decrease in the amount of spoonbill taken in the upper and middle Illinois River, following the construction of the La Grange dam, just above the town of Meredosia, has also been noted. During the extreme drouth of the past three years these fish evidently have not been able to negotiate the low dam across the Illinois River at Kampsville, since they have almost completely disappeared from the Meredosia region where they were common until 1928. The smallest specimen taken at Meredosia in recent years weighed more than 2 pounds. In March and April, 1930, Mr. Hunt caught 216 individuals in Allard Lake, and Kinneman Lake, floodplain oxbows of the Ohio River near Paducah, Kentucky. The smallest specimen taken there weighed 1.2 pounds. The length frequencies of the small Chester specimens and of these lake specimens, all taken between February 8 and April 25, 1930, fall into three well-defined modes at lengths approximating 10, 27, and 48 inches. It should be mentioned also that the Chester specimens, alone, fall into two modes, the larger of which corresponds with the smaller mode observed in the lakes. If these three modes represent one-, two-, and three-year- old individuals, the spoonbill is, indeed, a rapidly growing fish.

Illinois Natural History Survey, Urbana, Illinois.

Ichthyological Notes

ANOTHER BLUE PERCH.—In a recent number of Copeia (1932, No. 4) Professor Dymond recorded the capture of a blue perch in Lake Erie. I obtained a similar specimen on November 8, 1927, from the Bay of Quinte, Lake Ontario. As was the case for the specimen recorded by Professor Dymond, the form and markings were similar to that of the ordinary *Perca flavescens* Mitchill, but the ground color was blue rather than green or yellow, the blue cast also being noticeable in the dark vertical bars. The reports of Bay of Quinte fishermen indicate that although this color phase is not common there it is not as rare as it is reported to be in Lake Erie since in the Bay of Quinte one or several specimens are taken each year.—J. L. HART, *Pacific Biological Station, Nanaimo, British Columbia.*

SMELTS IN LAKE ONTARIO.—On September 9, 1931, I secured a specimen of smelt (*Osmerus mordax*) in Lake Ontario, about two miles off Bowmanville. This specimen was taken in the nets of Mr. Wm. F. Depew, who states that to his knowledge smelts had never previously been taken in that locality. During the past summer (1932), however, several specimens were taken. Mr. Depew adds that the only time they were caught was when the water was very warm and there was a heavy current running up the lake from east to west.—E. J. R. MASON, *Royal Ontario Museum of Zoology, Toronto, Ontario.*

IMOSTOMA SHUMARDI IN NORTHWESTERN ONTARIO.—While engaged in fisheries investigations for the Ontario Department of Game and Fisheries, on July 28, 1931, Mr. A. C. Green and I seined a specimen of the darter, *Imostoma shumardi*, in Vermilion creek in northwestern Ontario. Vermilion creek flows from Big Vermilion lake to Pelican lake on the English river system, which is in the Hudson bay drainage area. The other darters taken at the same point were *Boleosoma nigrum* and *Percina caprodes*. Dr. Hubbs, who identified the specimen for us, states that this is, to his knowledge, the first record of the occurrence of this species in Ontario. The species has, however, been recorded from the Ontario-Minnesota boundary waters in the English River system, by Evermann and Latimer (1910), and also from Winnipeg, by Eigenmann and Eigenmann (1892), under the synonymic name *Hadropterus güntheri*.—JAMES SAVAGE, *Royal Ontario Museum of Zoology, Toronto, Ontario.*

THE FLATFISH *SYACIUM PAPILLOSUM* (LINNAEUS) IN LOUISIANA.[1]—On June 10th, 1932, the writer, while collecting trawl samples for the Shrimp Investigations of the U. S. Bureau of Fisheries, twelve miles offshore southeast of Grande Isle, Louisiana, in 8 fathoms of water, took eighteen specimens of a flatfish, which, on subsequent examination, proved to be *Syacium papillosum* (Linnaeus). The identification was kindly corroborated by Mr. Isaac Ginsburg of the Bureau of Fisheries at Washington, D. C. The species has not been reported before from Louisiana and, so far as can be determined, has not been recorded west of Pensacola, Florida.

On July 30th, 1932, forty more specimens were taken in East Bay at the mouth of the Mississippi River in five fathoms of water. In this group there were 31 males, ranging in standard length from 8.37 cm. to 12.74 cm. There were 9 females, ranging in standard length from 8.22 cm. to 10.96 cm. Four of these had ripe ovaries.

On October 30th, 1932, one lone specimen was again taken twelve miles off Grande Isle.

The entire blind side of all the specimens taken was pale. In this they resemble the southern ones from Brazil, rather than the northern specimens of the Carolina and adjacent waters, which, according to Jordan and Evermann, and Hugh M. Smith, are usually partly or wholly dusky on the blind side.—GORDON GUNTER, *U. S. Bureau of Fisheries Shrimp Investigations, New Orleans Court Building, New Orleans, Louisiana.*

[1] Published by permission of Commissioner of Fisheries.

NOTES ON A LARGE BOWFIN (*AMIA CALVA*) LIVING IN A MUD-PUDDLE.—While collecting fish at Cross Lake, Onondaga County, New York, on August 19, 1929, I discovered, to my surprise, a large bowfin (*Amia calva*) living in a small artificial pond that was nearly dry. It was practically the only survivor of several hundred fish, both adult and young, including large-mouth black bass, yellow perch, sunfish, bullheads and several species of cyprinids that had become separated from the lake when the water receded following the spring freshets. One does not often find the bowfin in such an isolated habitat and so this was an unusual opportunity to obtain first-hand knowledge on its ability to thrive under such adverse conditions.

Several years ago the pond in question was part of a boat slip, about 150 feet long, 20 feet wide and 4 feet deep. The mouth of this slip was subsequently filled with silt and débris, which have been allowed to remain. The pond normally is dry by August or September.

The water in the pond on the above date was so shallow that the bowfin was unable to swim from the small depression where it was stationed and even here its back protruded from the water. It remained motionless until I approached with the net, but then it became frantic, working itself into the soft bottom ooze about three or four feet from its original position. It became mired in the mud and completely hidden from view. Later when I scooped the fish out of the mire with a net there was so much mud clinging to it that a bath was decidedly in order. Although the water was extremely warm it contained sufficient algal material to prevent stagnation.

This bowfin was a female, 25 inches long (total length) and appeared to be in good health. The ova were well developed, indicating that she would have spawned the following spring. The stomach was empty.

A great blue heron left the pond as I approached and there were numerous tracks of this bird about the pool margin. A number of adult bullheads (*Ameiurus nebulosus*) were strewn about the shore, having their enterons torn out and devoured. I attributed this work to the great blue heron, since I have numerous records of this bird taking bullheads in like manner from spawning beds. Many of the fish noted in the pond earlier in the season were undoubtedly taken by the bowfin. Then, too, the half-dozen or so adult watersnakes (*Natrix sipedon*) living about the pond probably availed themselves of this convenient food supply.—WILFORD A. DENCE, *Roosevelt Wild Life Station, Syracuse University, Syracuse, New York.*

NEW FISH RECORDS FROM SOUTHERN CALIFORNIA.—Three interesting fishes, two of them apparently new additions to the California fauna, have recently come to me through the courtesy of Professor G. E. MacGinitie of the California Institute of Technology's Marine Laboratory at Corona del Mar.

1. *Euleptorhamphus longirostris* (Cuvier).—A typical specimen of this species, 270 mm in length from tip of upper jaw to base of caudal fin (tip of lower jaw broken off), was taken by Eddie Efferly at the entrance to Newport Bay, November 27, 1932. This appears to be the first time that this fish has been recorded from California, its usual range being from the East Indies to Hawaii and the Galapagos Islands.

2. *Ostracion diaphanum* Bloch and Schneider.—A specimen 114 mm in standard length, was found on Balboa Beach, December 4, 1932. The invasion of the waters of Southern California by this species seems to have been quite extensive as in addition to the numerous specimens recorded by Mr. Howard R. Hill (COPEIA, 1932, No. 4, and Bull. Sou. Calif. Acad. Sci., 32, pt. 1, 1933: 22, pl. 4) and the one noted above, Professor MacGinitie reports that four specimens have been found on beaches near Newport and one was brought in from San Juan Capistrano.

3. *Trachypterus ijimae* Jordan and Snyder.—A specimen 835 mm in standard length, was taken in a halibut net by Frank Horvath off Newport Beach in thirty feet of water, December 7, 1932. This is the first record of this rare fish from the eastern Pacific. Unfortunately the attenuated first dorsal spines and both pelvic fins were broken off close to the body.

Due to the briefness and cursory nature of the original description of this little

known species it may be well to add here a few details based upon the Newport specimen and upon one 533 mm in standard length, collected by Allen Owston at Numadju, Idzu, Japan on November 22, 1906. This latter specimen is now in the Stanford University Museum.

The head, 5.8 to 6.5 in standard length, is slightly deeper than long. The snout is short, 1.2 in the large eye which is 2.7 to 3.0 in head, Maxillary very broad, its width about equal to half its length. Maxillary and all bones of the opercular apparatus very thin and delicate but strongly rugose. Premaxillary with 6 to 8 sharp, canine teeth on each side, arranged in a slightly irregular single series, the anterior teeth the largest; dentary with 6 or 7 similar teeth on each side, the posterior ones the largest; 2 to 4 similar teeth occur in a line on the vomer and 2 or 3 on each palatine.

Dorsal fin VI-137 (Numadju specimen), VI-134 (Newport specimen). Each dorsal fin ray beset with a lateral series of minute prickles, the basal ones of considerable size, forming a row of small, sharp spines along base of fin. Pectoral fins inserted under posterior end of interopercle of 12 rays; its length slightly greater than diameter of eye. Pelvic fins I-5; inserted directly under pectorals; the spine about four times as heavy as heaviest ray, studded with small sharp spinules. There are nine rays in the upper lobe of the caudal fin and three in the lower. One or two small sharp spines are located in the midventral line at the base of the lower caudal ray.

Origin of lateral line high on head, about half-way between origin of dorsal fin and upper anterior corner of orbit. The lateral line descends abruptly to the upper posterior corner of orbit and then gradually from this point, approaching the ventral edge of the body and a half to two eye-lengths behind the anus and continuing to the base of the caudal fin. The tubular scales of the lateral line, delicate and unarmed anteriorly, show small central spines at about the level of the posterior end of the head. The scales with their spines increase in size posteriorly, a very abrupt enlargement taking place at the point where the lateral line approaches the ventral contour. From this point posteriorly each alternate scale is offset dorsally from its neighbors so that the lateral line persues a wavy course in traversing them.

On the tail of both specimens are a few very thin, deciduous, cycloid scales. It seems probable that in life the fish is almost completely scaled, for in each of the two specimens examined the skin is pockmarked by a large number of small pale spots suggesting scale scars.

Measurements in Hundredths of Standard Length

	Numadju Specimen	Newport Specimen
Greatest depth	19	23
Depth at anus	11	14
Distance from snout to anus	41	42
Length of head	15	17

The type of this species, "a young specimen about 1 ft. long", was reported as being silvery in color with no dark spots. The Numadju specimen (preserved in alcohol) is light brown while the Newport specimen (preserved in formalin) is grayish black. In each case there are about twelve diffuse and indistinct bands which are slightly darker than the ground color.— Rolf L. Bolin, *Hydrobiological Survey, Hopkins Marine Station. Pacific Grove, California.*

Herpetological Notes

THE SIZE OF *SISTRURUS CATENATUS CATENATUS* AT BIRTH.—What little has been written on this subject differs so greatly from my own observations that the following notes may be worth while to those who are interested in this rattlesnake.

Hay mentions (1887) two females giving birth to five and six young about September 1. The young were from three to four inches long at birth. Atkinson and Netting (1927) state "The female taken on July 11, 1905 contained seven four inch embryos . . . . The young contained in the July 11 female would surely have been born in another week. Thus we judge that in western Pennsylvania mating takes place late in April or early in May, and that from five to nine young are produced late in July or early in August."

A specimen killed August 17, 1930, which measured 23 ⅜ inches, was opened several days later and was found to contain three well developed embryos and five which were undeveloped. The three measured 7 ⅞ inches, 8 inches and 8 ⅝ inches.

A 23 ½ inch specimen caught on August 2, 1931, suffered a broken back when captured which caused the snake's death on August 21; probably a week or two before the time for parturition. As I was away when it died and did not return until decomposition had set in, only three of the eight embryos were in fair condition. The others were evidently about the same size, however. These three measured when preserved 5 ⅜ inches, 5 ½ inches, and 5 ¾ inches.

A 26 inch specimen taken July 26, 1931, gave birth to eight young on September 7 (which very appropriately was Labor Day). One, stillborn, and another which died shortly after birth, measured 8 inches and 8 ¼ inches respectively. The remaining six measured 8 ¾, 8 ¾, 8 ⅝, 8 ⅝, 8 ⅝, and 8 ⅜ inches in length. These young massasaugas were quite active soon after birth as they freed themselves from the placental covering very quickly.

On August 24, 1930, a 21 ½ inch massasauga was caught, together with five young which were with her. As all of the young ones shed within a few days, I presume that they had not been born very long before they were captured. Unfortunately, I measured only one at the time, although they all looked to be the same size. It was 8 ½ inches in length. On September 18 I measured them all. Four were 9 inches long and the other was 9 ¼ inches.

On September 7, 1930, a young specimen 8 ½ inches long was taken, which was probably not more than a week old. On September 18 it measured 9 ½ inches. A baby specimen caught September 10, 1931, was 9 inches in length.

All of the specimens mentioned were taken in western Pennsylvania from Butler and Venango counties. Most of them are now in the permanent collection of the Carnegie Museum. As a few of the measurements I made last year were in inches instead of in millimeters, all of the measurements given here are in inches to be consistent. Measurements were taken from the tip of the nose to the base of the rattle. The "button" on these young snakes averages about 3 mm., or ⅛ of an inch in length.

From the above information it would seem that the size of *Sistrurus catenatus catenatus* at birth is larger than former published records indicate, being approximately 8 ½ inches. Likewise the date of birth is later than formerly supposed, between the 15th of August and the 10th of September.

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PAUL L. SWANSON, *Wesley, Pennsylvania.*

NOTES ON *ASCAPHUS TRUEI* IN KITTITAS COUNTY, WASHINGTON.—Within the state of Washington, *Ascaphus truei* Stejneger has heretofore been known to occur in streams of the Olympic Peninsula, the western slope of the Cascade

Range and on Mount Rainier (Slevin, Occ. Pap. Calif. Acad. Sci., 16, 1928: 1–151). The easternmost record is North Bend, King County.

On September 3, 1931, a large number of *Ascaphus* tadpoles were found in a small, cold, swift-flowing stream which empties into the South Fork of the Snoqualmie River about ten miles east of North Bend. The altitude here is about 6,000 feet. These tadpoles were 50 mm. in length with the hind legs just developing. On September 4, 1931, four tadpoles of approximately the same size and stage of development were collected in Thetis Creek which flows into Lake Kachess, Kittitas County, at an altitude of 2,300 feet. Lake Kachess is in the Wenatchee National Forest and is on the east slope of the main Cascade Range. In the afternoon of September 4, a trip was made to Little Lake Kachess, which is just north of Lake Kachess and is connected with it. Another stream, Box Canyon Creek, which flows into Little Lake Kachess, was also found to harbor *Ascaphus truei* tadpoles of similar size and development. Four adult frogs, two males and two females, were also captured here. This marks the first time that this rare salientian has been found east of the Cascade Divide.

We had an excellent opportunity to note the habitat and observe the tadpoles of this frog. The stream emptying into the Snoqualmie River was a typical swift-flowing mountain stream about seven feet wide and varied in depth from a few inches to several feet. The temperature of the water at 1 P.M. registered 10° Centigrade. Here the tadpoles were very abundant, for as many as seven were seen and collected from an area that could be covered by the palm of one's hand. They were first observed in the clear water attached to the rocks on the bottom of the creek. Efforts made to capture them caused them to release their holds and swim upstream for a few inches and there seek shelter under the rocks. Here they were more difficult to see since their coloration blended nicely with the debris under the rocks, but once one knew where to look and what to look for, they were more obvious. As Gaige (Occ. Pap. Mus. Zool., Univ. Mich., 84, 1920: 1-9) rightly states, the only way to capture these tadpoles is to wade into the water and diligently turn over every small rock on the bottom of the stream. If the rocks are carefully overturned, the tadpoles will be found underneath. Their blackish bodies make them very conspicuous after the debris collected underneath the rock has been washed away.

Gaige (*op. cit.*) states that she had difficulty in keeping the tadpoles alive for more than a few hours. We, however, were able to keep more than a dozen alive in a pint jar for two days, although the temperature of the water rose at times to 15° C. Several were observed to climb up the glass jar out of the water so that their heads were exposed. This was accomplished by moving the anterior portion of the suctorial mouth forward, in this case upward, taking a new hold upon the glassy wall and then releasing the lower portion of the sucker. The tadpole thus moved up a little distance at a time until the desired height above water was reached. They also climb out of water in their natural habitat, for we saw two tadpoles lying totally exposed on damp rocks that were not reached by the spray. Another was seen attached to the side of a damp rock with its head above the water line. Their suctorial mouths and long muscular tails are undoubtedly adaptations, the former to hold them to the rocks and the latter to move them through the swiftly flowing water. They seemed to be found more abundantly in the swifter portions of the streams where the oxygen content is perhaps higher.

In counter distinction to the tadpoles, three of the adults captured in Box Canyon Creek were found under rocks in shallow quiet pools near the bank. Two of these were taken from the same pool. They were sitting quietly and might have passed unnoticed on account of their lack of motility and their greyish coloration, which blended perfectly with the background. The other adult had been sitting on a mossy bank and jumped into the water upon our approach. There it swam feebly for a few strokes until it was captured.

The authors believe that these toads are far more abundant within their range of distribution than is commonly thought, but are often overlooked because they are so inconspicuous. Until one has learned how to hunt for them, one is not apt to come across them except by merest chance.—ARTHUR SVIHLA and RUTH DOWELL SVIHLA, *Charles R. Conner Museum, Pullman, Washington.*

EXTENSION OF THE RANGES OF SOME WASHINGTON AMPHIBIA.—In checking over some recently acquired material in the Charles R. Conner Museum, I find that these records extend the ranges of the following amphibia in Washington, *Ambystoma gracile* (Baird), *Plethodon intermedius* Baird, and *Ascaphus truei* Stejneger.

Mr. John Branton of Brewster, Okanogan County, sent in two larval salamanders for identification on May 15, 1932. The specimens, 152 mm. and 158 mm. long, were found in a twelve foot well near Brewster and proved ot be *Ambystoma gracile* (Baird). Since Slevin[1] records the occurrence of this salamander in Washington along the coast from Neah Bay to Mount Rainier, its presence east of the Cascade Mountains is noteworthy.

A single specimen of the northwestern red-backed salamander, *Plethodon intermedius* Baird, has been presented to the Museum by Thelma Clarke and John F. Clarke. They collected it near Baker Lake, east of Mount Baker, Whatcom County, on August 9, 1931. Slevin (Occ. Pap. Calif. Acad. Sci., 16, 1928: 1-152) records this salamander as occurring in Washington only as far north as Marysville, Snohomish County.

Slevin (*op. cit.*) gives the northernmost record for *Ascaphus truei* Stejneger in Washington as 2,000 feet in the Cascade Mountains near North Bend, King County. Two adult specimens of this rare form were collected by Thelma Clarke and John F. Clarke during August, 1931, from Martin Creek, which is east of Mount Baker in Whatcom County. Here, according to the collectors, they were very plentiful, for at least 200 adults were seen as well as numerous tadpoles. Due to lack of adequate preserving materials, more specimens could not be collected. This brings the known range of this amphibian close to the Canadian border.—ARTHUR SVIHLA, *Charles R. Conner Museum, State College of Washington, Pullman, Washington.*

AN EXTENSION OF THE RANGE OF *HYLA GRATIOSA* LE CONTE.—During the spring and summer of 1932 a number of specimens of the Florida tree frog, *Hyla gratiosa* Le Conte, were taken in eastern North Carolina, in Beaufort County. The first specimen was taken at 9:20 P.M., on May 4, from a pond about five miles northeast of Washington, N.C. This individual was perched approximately eighteen inches above the surface of the water in a bush that was growing in the pond about twenty-five feet from the water's edge. The pond is a small one of about an acre in area, its greatest depth being not more than three feet. This specimen was not heard calling.

Another trip was made to this same pond on the night of May 25. *Hyla gratiosa* was observed calling while floating, highly inflated, on the pond surface. Eight males were collected between 9:00 P.M. and 10:00 P.M. No females were seen.

On the night of August 7 six specimens were taken in another pond about two miles northeast of Washington, N.C. One pair was found clasping. The female deposited a mass of eggs in the laboratory on the night of August 8, but these did not develop, as the male had previously ceased clasping.

A survey of previous records indicates that the known range of *Hyla gratiosa* is gradually extending. Cope (1889) says its range is restricted to Florida and adjacent parts of Georgia. Dickerson (1906) reports it from Georgia, Florida, and Mississippi only, and further states that its range is an unusually limited one. Stejneger and Barbour (1923) give its range as "South Carolina to Florida and Mississippi." Viosca (1923) has noted the species in Louisiana. Brimley (1926) gives South Carolina as the known limit of approach to North Carolina.

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SPERMATOPHORES AND THE MATING SEASON OF THE SALAMANDER *HEMIDACTYLIUM SCUTATUM* (Schlegel).—Spermatophores of *Hemidactylium* were first seen by the writer nearly four years ago. At that time it was intended to carry on a more complete study of these structures and the associated habits of the species; but since it has not proved possible to do this, the facts already obtained are here set forth for what they may be worth.

That mating is an autumn event was evident to the writer ten years ago from the invariable presence of spermatozoa in the cloaca of the females in spring, and their frequent occurrence in the latter part of October and in November. But at that time field work was not begun early enough in the autumn to find the spermatophores or mating.

In 1929, a collection of these salamanders made September 29 contained about 50 juveniles, 8 or 9 adult males and one adult female. This distribution of ages and sexes is typical of autumn collections,—many young of the year and nearly all the adults males. On the next day the adults of this collection were put into a covered dish together, and on the morning following (October 1) a spermatophore was found on the surface of a leaf. Its base was an expanded gelatinous disk, about 2 mm. broad, tapering upward into a stalk about 1 mm. in diameter, and ending in a pale yellowish top containing sperm. The whole was only 2 mm. high. On October 2, another spermatophore was found in the same dish on a bit of plant stem. It measured about 2 ½ mm. high and 2 ¼ mm. broad at the base. A third spermatophore, on a bit of leaf, had a conical form but the sperm mass was on its base at one side, as if it had slipped down. Another spermatophore was found on the next day on the bottom of the glass dish. The dish was so bare of materials that no spermatophores could have been missed. On October 4, a whitish mass protruding from the cloaca of the female proved on examination to be composed of spermatozoa.

A male and a female four-toed salamander collected on October 20, 1929, were put together in a finger bowl with a chip and a leaf, and kept until October 25. Then, as it was noted that the dish was rather dry, a little water was added. The next morning two spermatophores were present on the leaf, each about 2 mm. high and 2 mm. broad at the base. Neither had sperm on top, but at the base and side of one there was a mass of sperm. From one of these spermatophores the female had evidently taken the sperm mass, for a string of spermatozoa was easily pulled out of her cloaca; and either of the salamanders may have brushed the sperm mass from the other spermatophore. It appears that in this case the addition of water to the dry dish provided the stimulus necessary for deposition of the spermatophores.

In the following year (1930) spermatophores were obtained in September. A male collected on the 12th was, three days later, put with females. The next morning there was a spermatophore on the bottom of the dish, with its sperm mass pushed a little below the tip. The next day there was another spermatophore.

In all probability there is no congregation of sexes at mating time in this species. Much autumn collecting has shown that females are scattered and much harder to find than males, which, although also scattered, are rather easy to locate because they are in superficial situations. In the spring this condition is reversed: females are easy to find while males are scarce. The inference is that union of the sexes depends on the activities of the males in searching out the females. Whether this searching activity is influenced by rain or other climatic conditions needs to be studied, but it is conceivable that it is. When we have learned what conditions stimulate mating activity in this species, it may be possible to witness mating and spermatophore deposition under natural conditions.

These observations are few, but they show several things: (1) that there is an extended mating period lasting, in southern Michigan, from at least the middle of September to the latter part of October; (2) that spermatophores may be readily obtained in the laboratory; (3) that the males deposit only one or two spermatophores at a time; (4) that it should be perfectly possible to observe the mating behavior; and (5) that it is going to be rather difficult to find spermatophores and mating under natural conditions.—Frank N. Blanchard, *Department of Zoology, University of Michigan, Ann Arbor, Michigan.*

INCUBATION OF PAINTED TURTLE'S EGGS.—On June 26, 1931, I observed a rather large painted turtle laying her eggs in a hole which she had scooped out on my lawn, which is about 200 feet from water. The carapace of the turtle measured 4.5 inches wide and 6.5 inches long. Eleven eggs were deposited, the last at 5:30 P.M. She then covered the eggs, taking half an hour to complete the process, facing away from the hole, and alternating each hind leg to pull the sand into the hole. After covering the eggs to her satisfaction, and finishing off by pulling a few pieces of dried grass over the sand to further conceal the nest, she did not turn about to survey her work, but simply walked away. I marked the spot to check the incubation of the eggs.

The spot was not disturbed until seven weeks later, when I gently dug down to the top egg to see its condition. Incubation was rather advanced so thereafter I kept a careful watch to see when they would hatch. On September 8 I dug down again to the top egg and found that the young turtle had just hatched, and was still in part of the shell. There were nine young turtles and two dried eggs in the nest. The turtles were quite inactive when first placed on top of the ground, but after being exposed to the warm sun a short time they became very lively and started to crawl away. The measurements at hatching were:

	Length	Width		Length	Width
1.	31/32 inch	30/32 inch	6.	31/32 inch	30/32 inch
2.	1 "	31/32 "	7.	1 "	1 "
3.	31/32 "	30/32 "	8.	1 "	30/32 "
4.	31/32 "	30/32 "	9.	31/32 "	31/32 "
5.	30/32 "	29/32 "			

On September 15 my brother found a young painted turtle that had just hatched on his lawn, about 500 feet from my lawn. The carapace of this turtle measured 1 2/32 inches long and 31/32 inch wide.

The young turtles when hatched showed a prominent scar on the plastron, where the yolk was absorbed just before hatching: this scar had healed completely by October 5. The egg tooth was shed by October 5 by all but one of the young turtles. The remaining egg tooth was shed on October 9, when I touched it.

For the first few days after hatching I kept the young turtles in a five gallon pail, with sand and a dish of water. About an hour before dark they would bury themselves in a compact mass for the night, emerging in the morning. On a rainy night I covered the pail, leaving the cover on until noon of the following day. The turtles did not emerge from the sand until about fifteen minutes after the pail was uncovered.

After the first few days in the pail, they were placed in a wire pen 2 feet wide and 12 feet long, which was placed in a stream so they could search for food. I did not feed them during the 36 days that they were confined. They were as active on October 14, when I gave them their freedom, as at any time during their confinement. At this date two of the turtles measured respectively: length 30/32 and 31/32 inches, width 28/32 and 30/32 inches.—LE ROY WILCOX, *Speonk, Long Island, New York.*

FURTHER NOTES ON PAINTED TURTLES.—The brood of young painted turtles (*Chrysemys p. picta*) described by Mr. Wilcox above, were probably unusually advanced for this part of Long Island. My observations at Mastic, only a few miles west of him indicate that, unlike the snapping turtle young which one commonly finds out in September, those of the painted turtle may hatch in the fall but do not emerge from the ground until the following spring.

My records of young of this species which apparently had not yet reached the water, are as follows. One given me April 18, 1925, picked up 2 or 3 days previously; shell length 1 inch; egg tooth conspicuous. Young ranging from 7/8 to 1 1/16 inches found May 4, 1918; May 20, 1916; May 21, 29 and 30, 1921; May 30 and June 1, 1919. One of 1 1/16 inches shell length was found in the water May 31, 1924; and another of the same size away from water, during a heavy rain, July 23, 1927, but this last had presumably come out again on account of favorable conditions for cross-country travel.

From 1915 to 1928 I have 7 records of egg-laying, counting one where the turtle was preparing to lay, and one where it was judged to have just finished laying, due to muddy condition behind. Dates range from June 8 to July 17. Time of day was

recorded in 6 of the 7 cases, and was late afternoon; more exactly in 4 of the 6, from 4:30 to 5:30 P.M. (standard). In the 3 out of 7 cases weather was noted, it was sunny.

Eggs laid on July 17, 1925, were dug up, placed in a strawberry box and buried out of doors but where they could be better controlled. They were exhumed on April 3, 1926. In 4 the egg-shell was broken, showing the young turtle within, and a fifth young turtle was out of the egg. Its shell measured 7/8 inches long, and to judge from its muscular tonus it was still alive, but I was unsuccessful in bringing any of this brood to activity.

Eggs laid about June 25, 1928, were carefully marked as to place, but left undisturbed until it seemed very unlikely that they would emerge before spring even if by chance lack of frost permitted. On October 28, then, the nest was opened, disclosing 11 fully developed young turtles in a bunch with fragments of old egg-shells. They measured 1 to 1 1/8 inches shell length. Next day most of them were decidedly lively.—J. T. NICHOLS, *American Museum, New York City.*

ON *BACHIA INTERMEDIA* NOBLE AND *BACHIA BARBOURI* BURT.—It will be recalled that Perico, Peru, is the type locality of *Bachia intermedia* and that recently Burt (1931, *Bull. Am. Mus. Nat. Hist.*, 61: 318, figs. 5–8) described *B. barbouri* from the same locality, basing his description on a single example, one of the paratype series of *intermedia* in the American Museum of Natural History. In looking over the 267 paratypes of *intermedia* from Perico in the Museum of Comparative Zoology only one example of *barbouri* was found, but strangely enough no fewer than 20 out of 23 of the Bellavista specimens possessed the chief characteristics of *barbouri*, which I regard as a valid species.

In examining the Perico material it was observed that considerable variation is displayed by *intermedia*. Thus of 267 specimens, 259 were typical in possessing three toes on the fore limbs while 8 had either two or four toes on at least one of the fore limbs. While 260 had two pairs of chin shields in contact, even though narrowly, 6 had the hind pair separated but it was noteworthy that even in these none of the hinder shields intruded between the labials to reach the buccal border as in *barbouri*. One interesting lizard (M.C.Z. 14701) had only a single pair of chin shields resulting from the fusion of the anterior elements with the corresponding halves of the posterior. Two hundred and sixty-three lizards were normal in lacking an interparietal: 4 (of which 3 were normal in other characters) possessed interparietals, but in none of these did the interparietal separate the parietals posteriorly as is the case in *barbouri*.—A. LOVERIDGE, *Museum of Comparative Zoology, Cambridge, Massachusetts.*

BUFO LAMENTOR GIRARD.—In my recent study of Utah Amphibia, "A Synoptical Study of Utah Amphibia" (Utah Acad. Sci., 1931, VIII: 159-198, Pls. VIII-XX), I found that Mr. Charles Girard, 1859, described *Bufo lamentor* from several specimens collected at Fort Bridger, "Utah," Wyoming, by Mr. C. Drexler. Since this species is not mentioned by Cope (1889), Stejneger and Barbour (1923), or Slevin (1928), I have corresponded with several herpetologists in an effort to determine the present status of this form in our taxonomic series.

In a communication under date of January 28, 1932, Miss Doris M. Cochran, of the National Museum, writes: "We have the four co-types of *Bufo lamentor*, U.S.N.M. 4194, from Ft. Bridger, Wyoming, collected by C. Drexler in 1858 and described by Girard, Proc. Acad. Sci. Philadelphia, Vol. 2, 1859, p. 169. The toads are now catalogued as *Bufo boreas*, and while they are not in the best of condition they are better than some of our old types and the color markings and head contours are still quite distinct."

One of the four above mentioned specimens of *Bufo lamentor* was loaned to the writer by Dr. A. Wetmore, of the National Museum, and it has been studied and compared with a series of *Bufo boreas boreas* from various parts of the northern intermountain region. The color markings, head, absence of cranial crests, parotoid glands, spotted venter, and measurements of this specimen so closely agree with *Bufo boreas boreas* that there can be but little doubt that it belongs with this species.

It would seem, therefore, that *Bufo lamentor* Girard is a synonym of *Bufo boreas boreas* (Baird and Girard) and should be treated thus in monographic studies of the United States Batrachia.—VASCO M. TANNER, *Brigham Young University, Provo, Utah.*

A LARGE ALLIGATOR SKULL.—I remember as a boy of twelve seeing in the store of a taxidermist of Rock Ledge, Florida, an extraordinarily large and handsome skull of the American alligator. Last week the possessor of that skull, Mr. H. C. Eyer, gave it to the Museum of Comparative Zoology.

The 'gator was killed in the Sebastian River, Florida, in 1888, and the skull measures 640 mm. in total length. It now bears the number Mus. Comp. Zool. 34323.

The largest alligator in our possession previously has been the big, mounted specimen from Louisiana, Mus. Comp. Zool. 17722, whose skull measures 540 mm. and the total length of the mounted skin, probably somewhat shrunken, 3270 mm.

It ran in my mind that Old Mose, the giant alligator which was obtained in 1899 by the New York Zoological Society from Cocoa, Florida, was larger than our mounted specimen but my recollection is that Old Mose had lost a considerable piece off the end of his tail. My helpful colleague, Mr. Loveridge, at my request, wrote Mr. Ditmars of the New York Zoological Park and got the measurements of Old Mose which, transferred to the metric system, give the length from snout to occiput of 456 mm. and a total length for the alligator of 3838 mm.

There is in the so-called Alligator Farm at Jacksonville a single individual which is somewhat over thirteen feet in length. I would be very interested in hearing from custodians of other collections concerning whether or not they know of any skull larger than the Sebastian specimen.—THOMAS BARBOUR, *Museum of Comparative Zoology, Cambridge, Massachusetts.*

A LIZARD NEW TO OHIO.—In Salt Creek Township, Hocking County, Ohio, on October 2, 1932, as I began to notch a large dead chestnut tree preparatory to cutting it down, a small lizard, of a species unfamiliar to me, scampered rapidly down the trunk following one of the furrows in the bark. The animal was captured and submitted to Mr. Charles F. Walker, of the Ohio State Museum at Columbus, who identified it as *Leiolopisma laterale.* There seem to be no other Ohio specimens of this southern species, although Dr. Kirtland,[1] nearly 100 years ago, wrote "S. [Scincus] quinquelineatus and S. lateralis were shown to me by Mr. Dorfeuille, as inhatitants of Ohio." The Dorfeuille collection at Cincinnati was destroyed long ago and no subsequent Ohio records of this lizard are known to me.

This specimen, now No. 435 in the Ohio State Museum collection, represents an appreciable northern extension of the known range of the species. It is a rather small individual with a head and body length of 44 mm. The tail has been broken and shows slight signs of regeneration.—ARTHUR STUPKA, *Laurelville, Ohio.*

THREE GENERATIONS OF COTTONMOUTHS, *AGKISTRODON PISCIVORUS* (LACÉPÈDE).—On August 13, 1929, R. Marlin Perkins, Curator of Reptiles of the St. Louis Zoo, his assistant, Moody Lentz, and the writer collected a gravid cottonmouth, *Agkistrodon piscivorus* (Lacépède), near Murphysboro, Illinois. September 19 of the same year this specimen gave birth to 15 young, 4 of which, a female and 3 males, are still alive and thriving in captivity in the Toledo Zoological Park. Segregated from other snakes of the same species these 4 have been confined in a special cage, and July 17, 1932, the young female at the age of two years and ten months produced 2 offspring. The specimens were not observed breeding and no notes are available on the period of gestation. While these snakes have been kept in a warm building during the winters they have each year ceased feeding in the late fall and have begun eating again in the early spring. The conditions have been far from natural but the data indicate that the cottonmouth is capable of reproducing in its third year. Measurements and weights of the 4 snakes of the second generation at three years of age are as follows:

Male	752 grams	1017 mm.
"	452 "	930 "
"	381 "	868 "
Female	570 "	846 "

One of the juveniles of the third generation, a female, died a short time after birth and when measured was found to be 273 mm. in length. The other, a male, fed regularly at weekly intervals and at the age of four months weighed 20 grams and measured 315 mm. Circumstances unfortunately prevented the measurement of both litters of young at birth.—ROGER CONANT, *Toledo Zoological Society, Toledo, Ohio.*

[1] Ohio Geological Survey, Second Annual Report. Columbus, 1838: 188.

NOTES ON WASHINGTON SALAMANDERS.—*Rhyacotriton olympicus* (Gaige) has been reported from the following four localities, all on the Olympic Peninsula: Lake Cushman, Mason County (type locality); Lake Quinault, Chehalis, now Gray's Harbor County; near Spruce, Jefferson County; and Forks, Clallam County.[1] No records have been published for any localities south of Lake Cushman and Lake Quinault.

The rare salamander *Plethodon vandykei* Van Denburgh has been reported from three localities: Paradise Valley, Rainier National Park, Pierce County; Calawa River near Forks, Clallam County; Skokomish River Valley, Mason County, Washington.[2]

On September 26, 1931, while on a field trip in southwestern Washington, with Franklyn Hueston for a companion, I took several *R. olympicus* near a small stream by the highway six miles west of South Bend, Pacific County. *Dicamptodon ensatus, Plethodon intermedius,* and *P. vandykei* were taken under moist stones near the base of a small falls, within ten feet of the place where *R. olympicus* was found.

Later in the same day I took *R. olympicus* at a small stream three miles east of Gray's River, a village in the western part of Wahkiakum County. *Dicamptodon ensatus* and *Plethodon intermedius* were also taken near this tiny stream.

Later on the same trip, I took several specimens of *R. olympicus* and one of *P. intermedius* at a falls on the highway 1.7 miles west of the Wahkiakum-Cowlitz County line. These falls are within a stone's throw of the Columbia River and eighteen miles west of the Pacific Highway at Kelso and Longview. The nearest town is Oak Point, four miles to the east. This station is ninety miles south of any previously reported location for *R. olympicus,* and nearly triples its previously known range.

It has been stated that *R. olympicus* "is usually found under stones and moss in small streams"[3] but this, I believe, is because the collectors have hunted for them only during the day. *R. olympicus* hides under stones and moss during the day, but at night it emerges and crawls about over them in search of food. On many night trips along small streams in the Olympics during the past few seasons, I have collected these salamanders on stones and moss a few feet away from the water. At the same time, very few specimens would be revealed by turning over the stones in the stream bed.

During 1931 I took specimens of *Plethodon vandykei* at Forks, Clallam County, on April 9; in a forest six miles northwest of Morton, Lewis County, on April 25; at the head of Carbon River on the north side of Ranier National Park, Pierce County, on May 16; and six miles west of South Bend, Pacific County, on September 26. This doubles the previously known range of *P. vandykei.*

The specimens from near Morton were taken from under moist slabs of bark at the base of a dead, giant Douglas fir tree far from any stream. All the other specimens were found under moist stones and moss near running water.—JAMES R. SLATER, *College of Puget Sound, Tacoma, Washington.*

TWO RECORDS OF THE LEATHERBACK TURTLE ON THE CALIFORNIA COAST.—In early July, 1929, fishermen brought in a *Dermochelys schlegelii* to the Monterey Pier, where it was examined and measured by Messrs. Joseph Wales, William Dill, the writer, and others. Measurements were as follows: Estimated weight 725 lbs., total length (horizontal measurement) 195 cm., length of carapace 159 cm., width of carapace 88.8 cm., tail 12 cm., tip to tip of outstretched flippers 230 cm. The head was injured, having been struck by the fishing boat's propeller.

Later in the same month another leatherback seems to have been captured and brought to Fisherman's Wharf in San Francisco, also injured in the head. A photograph of this specimen was reproduced in the *San Francisco Chronicle,* Automobile Section, Sunday, July 21, 1929.—GEORGE S. MYERS, *Stanford University, California.*

[1] Slevin, Joseph R., The Amphibia of Western North America. Occ. Pap. Calif. Acad. Sci., XVI, 1928: 40.
[2] Ibid.: 59.
[3] Ibid.: 44.

EDITORIAL NOTES AND NEWS

The Society and Copeia

THE Society is weathering the depression fairly well. The officers are gratified at the loyalty of the members. Conditions, however, are imposing somewhat of a financial strain on the journal COPEIA, which receives nearly all of the Society's income. Members are urged to cooperate in the support of the journal by paying their dues promptly, and if possible to plan on taking out a life membership, or contributing directly to the proposed publication fund.

The restricted income of several museums and journals and the suspension of the *Bulletin of the Antivenin Institute* have contributed to the flooding of the Editors with manuscript for COPEIA. Many very excellent papers have been lost to the journal, and long delays have ensued in the publication of others. Assurance of prompt publication can now be offered only when authors or their institutions offer to pay for the cost of printing (approximately $4.00 per printed page, plus cost of cuts). In this connection, we may mention that the cost of the recent articles by Helen T. Gaige and by L. C. Stuart were paid for by the authors. The cost of the half-tone frontispiece of Barton Warren Evermann in the last number of COPEIA, and of the leaflet on amphibian conservation distributed by the Secretary, were generously paid for by one of the members.

The 1933 Meeting

THE annual meeting of the American Society of Ichthyologists and Herpetologists will take place this year at the Museum of Comparative Zoology, Cambridge, Massachusetts, on May 11 to 13. The plans for what will likely prove a very successful meeting are being prepared by the Local Committee, Mr. A. LOVERIDGE, Chairman (Museum of Comparative Zoology), Mr. W. C. Schroeder and Mr. C. V. MacCoy. Titles of papers, with statement as to time, method of illustration if any, etc., should be sent to Mr. Loveridge as soon as possible.

Headquarters of both societies will be at Hotel Continental, Chauncy Street, Cambridge. A flat rate of $2.00 a person per night is offered for single rooms with bath, but as the number of single rooms will be limited, it will be necessary for some to occupy rooms with twin beds. An excellent restaurant is attached to the hotel. Full particulars with a map of location, may be had on application to the manager.

Western Division

THE Western Division of the American Society of Ichthyologists and Herpetologists will meet this year, as usual, with the Pacific Division of the American Association for the Advancement of Science. The meetings will be held during the interval of June 12 to 15, at the University of Utah, Salt Lake City, Utah. Titles should be sent to Prof. L. E. Griffin, Reed College, Portland, Oregon.

The New York Division

ON January 7, 1933, sixteen members of the American Society of Ichthyologists and Herpetologists residing in and about New York met at the American Museum to organize an active local division. Among those present were the founder of the Society, J. T. NICHOLS, and the president, C. M. BREDER, JR. DR. E. W. GUDGER was selected as Chairman and C. RALPH DESOLA (333 Central Park West) as Secretary. It was agreed that monthly meetings would be held.

The first regular meeting of the Division was held on January 18 at the American Museum. A *"Sea Snake Discussion"* was participated in by members Kauffeld, Gregory, Raven, Pope and Nichols and by the guest of the evening, Lt. Commdr. L. N. Linsley, U.S.N. There followed a *"Mola Symposium,"* with an exhibition by Dr.

Gregory of a dissected specimen. Tee-Van and Gudger contributed to the discussion. Twenty were present.

The second meeting was held on February 15 at the New York Aquarium and was given over to a discussion of "Sea Turtles."

The third meeting was held on March 15, at the home of John Tee-Van, who led the discussion on color phases of fish.

Larvae and Postlarvae

THERE is much looseness, especially in America, in the use of the term *larva,* as applied to fishes. Some have even extended this term to include juvenile and in some instances even half-grown fishes. It would seem much better to follow the usage of European workers, who have contributed much more than Americans to the knowledge of the early life-history of fishes. Thus, *larva* should refer to the recently hatched fish still provided with yolk. A *postlarva* is a fish with egg sac absorbed, but retaining larval features unlike those of the adult. The French term *alevin* has been used for salmonid larvae, but seems unnecessary. The term *embryo* should be restricted to the unhatched or unborn fish.

Expedition News

PRESIDENT C. M. BREDER, JR., of our Society, has recently returned to the New York Aquarium, from another expedition to the Bahamas. He reports further success in his field observations.

The Caribbean explorations begun by the Yale Oceanographic Expedition to the Gulf of Mexico last year, are being continued this year in cooperation with the Woods Hole Oceanographic Expedition, under the leadership of PROF. A. E. PARR. While major emphasis is being laid on a study of oceanic circulation, biological material is also to be collected. An effort is being made to measure roughly the abundance of the larger deep-sea animals by the use of a triangular otter trawl with a much larger opening than that of any trawl previously employed in deep-sea work.

DR. THOMAS BARBOUR is on his way to visit the Bahamas and Haiti, after which he will make his annual inspection of the Barro Colorado Island Station and the Harvard Botanical Gardens in Cuba. He will return to this country the first of May.

L. C. STUART, of the Division of Amphibians and Reptiles, University of Michigan Museum of Zoology, is leaving for an expedition to Guatemala. He will work with the botanist C. L. Lundell about Lake Petén, and in the adjacent savanna region.

DR. P. J. SCHMIDT has recently sent to the Ichthyological Editor of COPEIA a news digest of the huge fisheries expedition which he led last year in Far Eastern waters. Detailed ichthyological, general zoological, fishery and oceanographic explorations were carried on in the Sea of Japan, Okhotsk Sea and Bering Sea. The "chief aim was to elucidate the distribution of the food fishes, their biological conditions and their connection with the hydrological conditions. In the last years in connection with the Five Year Plan our fisheries there were greatly increased and many new fishery industries arose." The expedition was undertaken to create a scientific base for the development of these new fisheries.

The expedition was organized by the Pacific Scientific Fisheries Institute in Vladivostok, with the assistance of hydrographic institutes in Leningrad and Moscow. Dr. Schmidt states that funds to the amount of two million rubles were allotted to this purpose by the State and by the State Fishery Trust ("Vostokryba"). Six vessels were used, five steam trawlers and the motor schooner "Rossinante" of the Vladivostok Institute.

The general supervision was by Dr. Schmidt, who took detailed charge of the ichthyological work. Prof. K. M. DERUGIN directed the hydrological and zoological work. "The staff of expedition contained 67 hydrologists, chemists, zoologists, ichthyologists and their assistants, mostly young naturalists from Leningrad, Moscow and Vladivostok."

On each of the three seas two vessels were used, one primarily for oceanographic and the other chiefly for ichthyological work. A number of cross-sections were made

across each sea. A vast amount of zoological material and of oceanographic data were secured. More than 300 hydrographic stations were occupied, more than 500 otter trawls made, and more than 15,000 fish measured, weighed and dissected. Large zoological collections were made, and these are now being studied. "It can be said, that now we know our Far Eastern Seas and their ichthyological conditions considerably better than one year ago."

Dr. Schmidt hopes that the explorations will be continued this year.

Trout Work in California

JOSEPH H. WALES has been appointed Biologist in the California State Bureau of Fish Culture, which is headed by PROFESSOR JOHN O. SNYDER. His headquarters will remain at Stanford University, though he will spend much time at the fish cultural station at Shasta. His work will be largely along the line of fish pathology. Mr. Wales' place on the cooperative trout survey of California, being continued under the direction of PAUL R. NEEDHAM and ALAN C. TAFT, has been taken by LEO SHAPOVALOV.

Edwin Chapin Starks

ONE after another the members of the Old Guard of American ichthyology pass on. Seth Eugene Meek, Samuel Garman, Carl H. Eigenmann and Charles Henry Gilbert preceded their master, David Starr Jordan. In the last issue we recorded the death of Barton Warren Evermann, and now we must report the passing of Edwin Chapin Starks, another prominent member of the Jordan school. His death occurred on December 29, in his sixty-sixth year.

Professor Starks was born at Baraboo, Wisconsin, on January 25, 1869. He spent his youth mainly at Chicago. After receiving his college training under Jordan and Gilbert at Stanford and on expeditions, he worked for two years in the Biological Survey under Dr. Merriam. After taking part in the Harriman Expedition to Alaska, Starks joined the staff of the University of Washington where he built up a collection of fish skeletons which anticipated his later work in fish osteology.

Very soon thereafter, Jordan called Starks to Stanford, as curator of zoology. Later he joined the teaching staff in zoology, retiring as associate professor in 1932.

Professor Starks made his most impressive contribution in the field of fish osteology. His descriptive osteologies of certain species or families of fishes, beautifully illustrated by his wife Chloe Leslie Starks; his related interpretations of the classification of fishes; his comparative studies of special bones or of special skeletal structures, and his very useful *Synonymy of the Fish Skeleton,* are among the very best contributions ever made in these fields: a worthy monument for any man. Like the other ichthyologists of the time, he contributed extensively to the great *Fishes of North and Middle America.* Starks' first independent papers (1896) dealt with the fish fauna of Puget Sound, an interest which was maintained, and led to several other papers on West Coast Fishes. Other faunal works were based on collections from Ecuador and Peru (1906) and from Brazil(1913), but his most extensive

systematic work, in coauthorship with David Starr Jordan, dealt with the fish fauna of Japan, Chôsen, Manchuria and Ceylon.

An interesting and informative obituary notice on Starks appeared in the February 17 issue of Science (pp. 182–183). This notice, prepared by his colleague F. M. MacFarland, not only summarizes the scientific career, but also gives a fine word picture of the interesting personality, of this last member of the Old Guard to pass on.

Johannes Schmidt

IT is with profound regret that American colleagues hear of the death of the great Danish biologist and oceanographer, Dr. Johannes Schmidt, Director of the Carlsberg Laboratorium in Copenhagen. He was known throughout the world for his solution of the problem of the reproduction of eels,—one of the outstanding triumphs in the progress of natural history research. In solving this problem, long expeditions to distant seas were undertaken, hundreds of trawlings were made, immense quantities of material were gathered and prolonged laboratory studies were carried through to completion, or were still being prosecuted at the time of his death. The research will long remain a splendid model, as to methods, energy, magnitude and achievement.

Whatever problem Johannes Schmidt undertook, was carried through in masterful fashion. The work of his youth on the early stages of European food fishes gave promise of his future leadership. His more recent work on the race problems in fishes are the finest and most extensive of any ever carried out. His classic studies of races in *Zoarces* will be an enduring monument. The mind of a master was evident also in his researches in oceanography and in genetics.

In his life span of 56 years, Johannes Schmidt performed the work of a half-dozen able investigators. We continue to admire his energy and his accomplishments.

John Kern Strecker

ON January 9, last, John Kern Strecker passed away quietly at his home in Waco, Texas. With his going, Baylor University and Texas have lost an outstanding scientist in the field of natural history. Born in Illinois, educated in the public schools of that state and of Missouri, he came to Waco at an early age. In 1903, Mr. Strecker became curator of the Baylor University Museum and its collections are the result of his untiring efforts and interest.

Trained as a stone cutter and without a college education, Mr. Strecker became an outstanding authority on the natural history of Texas. His published writings number more than seventy separate articles in the fields of herpetology, ornithology, mammology, and conchology. These have been of inestimable value in the study of the fauna of Texas and of the surrounding states.

It is expected that, in a few weeks, Baylor University will announce plans to continue the work begun by Mr. Strecker.—WALTER J. WILLIAMS, *Baylor University, Waco, Texas.*

Recent Deaths

WE regret to announce the sudden death on November 1 of N. J. Atkinson, one of the Canadian fisheries workers. Mr. Atkinson was born in Wales, was a graduate and gold medallist of Saskatoon University and took his master's degree at the University of Illinois. Thereafter he became biologist for the large club holdings of the Lucerne-in-Quebec Association, which position he held until his death. In this capacity he was making valuable contributions to our knowledge of fish habits, fish increase and fish diseases. The passing of so promising a fisheries investigator at the age of 31 is very unfortunate.

PROFESSOR JAMES JOHNSTONE, eminent British oceanographer, and formerly director of the Marine Biological Station at Port Erwin, died recently.

E. B. WILLIAMSON, Research Associate in the Museum of Zoology, University of Michigan, leading student of the Odonata, but also widely known as a general naturalist and coauthor of reports on the fishes of Ohio, died at Ann Arbor on February 28.

DR. H. VON W. SCHULTE, of the School of Medicine of Creighton University, and a member of our Society, died on July 13, 1932.